

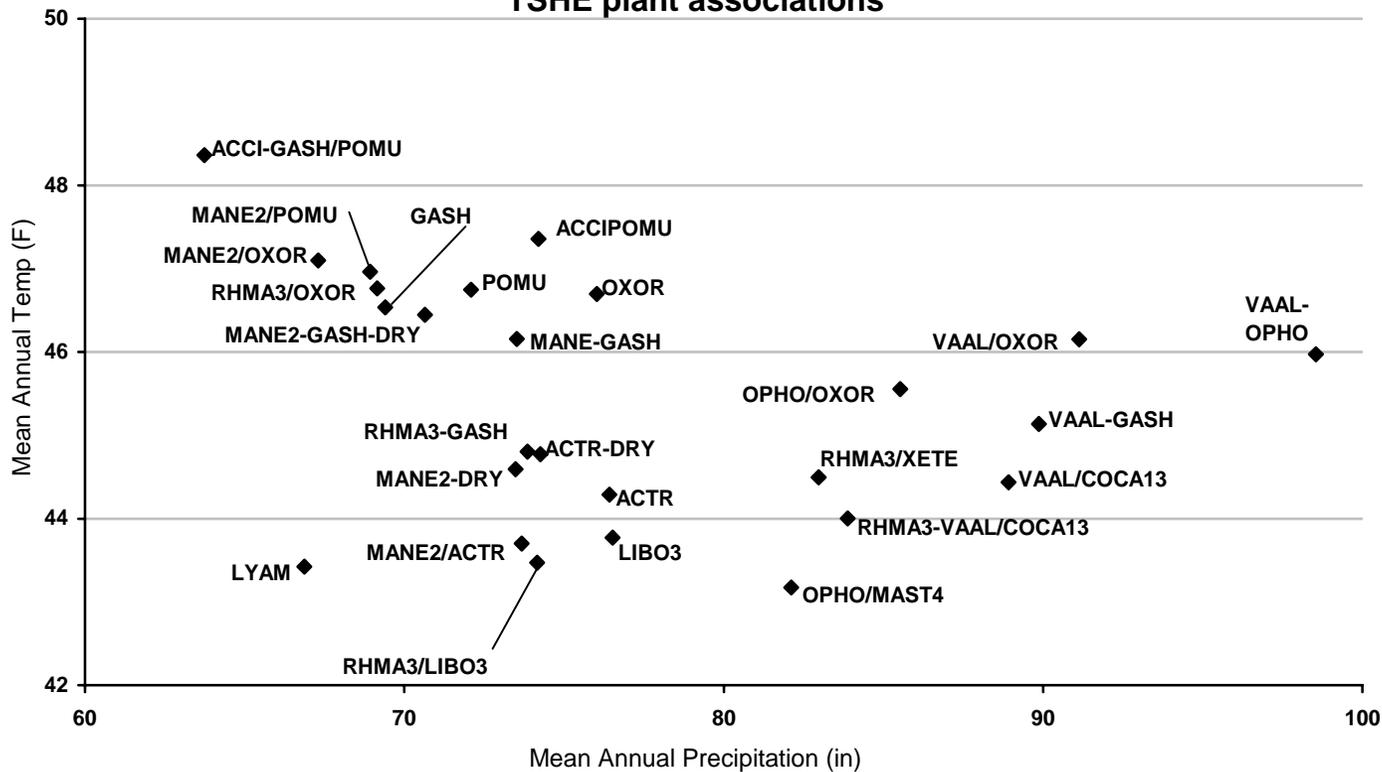
## **Introduction to western hemlock series:**

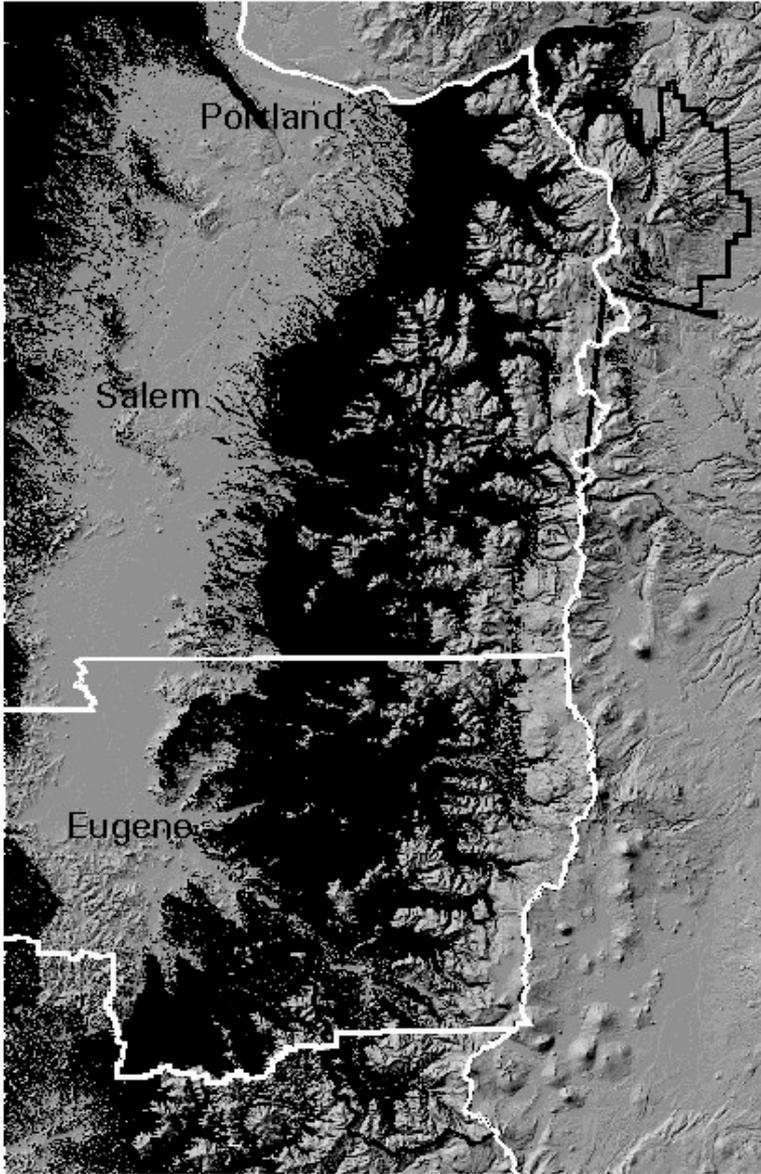
### Introduction to the western hemlock series

The moist, mild western hemlock zone dominates the westside Cascades of northwest Oregon. It spans a wide range in precipitation and temperature, but generally lies above the warm, dry Douglas-fir and grand fir zones and below the cool Pacific silver fir zone. Precipitation falls as rain or snow, but winter snowpacks are not deep or longlasting.

The graph on the next page shows the relative distribution of the plant association plot averages for mean annual temperature versus total annual precipitation (data from Oregon Climate Service's statewide GIS layers).

## TSHE plant associations





Western hemlock series distribution

Series distribution (in black) from 2001 draft USFS R6 Potential Natural Vegetation model (Henderson, in prep).

# Western hemlock/vine maple-salal/swordfern-NWO Cascades

*Tsuga heterophylla/Acer circinatum-Gaultheria shallon/*

*Polystichum munitum*-NWO Cascades

TSHE/ACCI-GASH/POMU-NWO Cascades

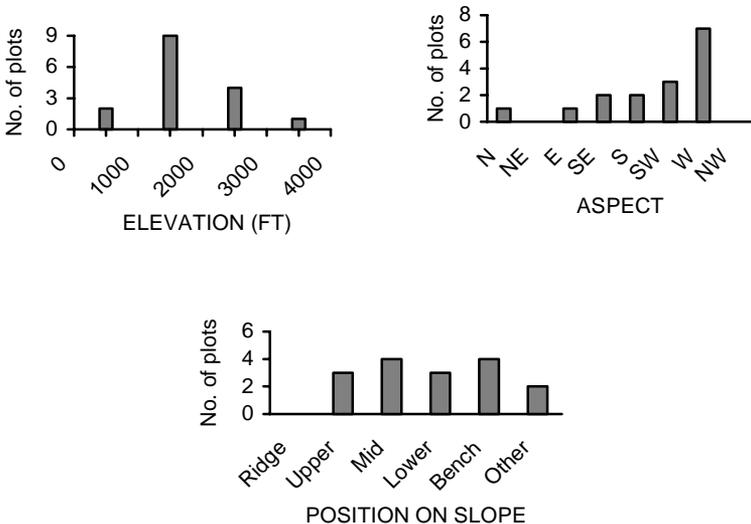
CHS232

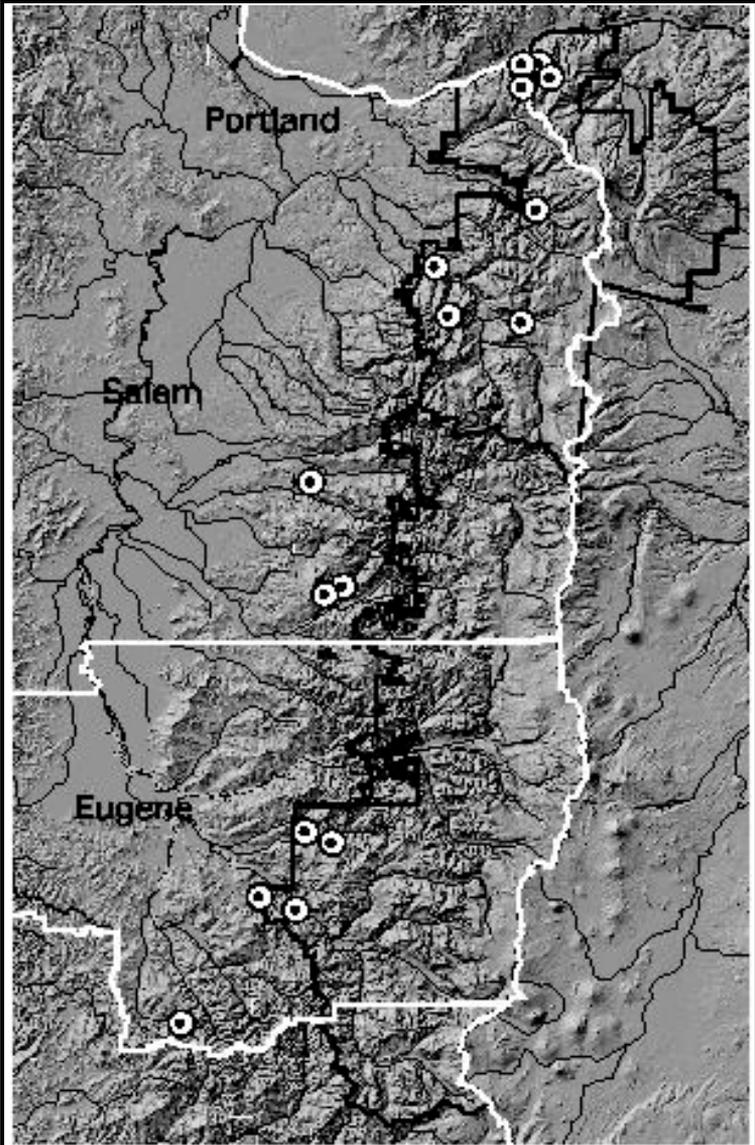
N=16 (MTH=2; WILL=10; EBLM=2; SBLM=2)

## Environment and Distribution

This somewhat uncommon plant association occurs throughout the central Old Cascades. Plots are located on flat to steep slopes averaging 33% (range 2-80%) on lower to upper slope positions. Most plots are on south to west aspects. This association occurs at relatively low elevations, with elevation of plots averaging 1,722 feet (range 820-3,040 ft.).

Soils are typically well-drained, silty clays.





TSHE/ACCI-GASH/POMU-NWO Cascades

## Vegetation Composition, Structure, and Diversity

The overstory in the TSHE/ACCI-GASH/POMU-NWO Cascades association is dominated by Douglas-fir, often with a large component of western hemlock. Canopy closure of mature trees averages 72%. Cover of understory trees averages 8%. This association has a well-developed shrub layer, with tall shrubs averaging 40% cover and low shrubs averaging 53% cover. The shrub layer is dominated by vine maple and salal, both of which are always present. Other common shrubs include dwarf Oregon grape, California hazel and red huckleberry. The composition of the shrub layer is typical of warm, moderately dry sites. Herbaceous cover averages 45%, dominated primarily by swordfern. Moss cover averages 18%.

Common name	Code	Constancy	Cover
<b>Overstory trees</b>			
Douglas-fir	PSME	100	56
Western hemlock	TSHE	88	22
<b>Understory trees</b>			
Western hemlock	TSHE	75	7
Cascara buckthorn	RHPU	31	1
Douglas-fir	PSME	25	2
<b>Shrubs</b>			
Vine maple	ACCI	100	33
Salal	GASH	100	44
Dwarf Oregon grape	MANE2	88	7
Trailing blackberry	RUUR	88	2
Red huckleberry	VAPA	81	6
California hazel	COCO6	63	7
Baldhip rose	ROGY	63	2
<b>Herbaceous</b>			
Swordfern	POMU	100	21
Sweetscented bedstraw	GATR3	75	1
Inside-out-flower	VAHE	69	1
Oregon oxalis	OXOR	63	5
Bracken fern	PTAQ	63	3
Pacific trillium	TROV2	63	1
Three-leaved anemone	ANDE3	56	2
Redwoods violet	WISE3	56	4
Pathfinder	ADBI	50	1

On average, stands in the TSHE/ACCI-GASH/POMU-NWO Cascades sample are 144 years old and range from 53 to 250 years old. Stands are moderately stocked, with live basal area averaging 249 ft<sup>2</sup>/acre.

There is an average of 26 vascular plant species per plot. This is an average value for the western hemlock series, and for other forested series in western Oregon.

### Management Implications

These tend to be productive forest sites. Douglas-fir grows well with an average site index of 165, well above the 136 average for the western hemlock series in the Cascades. On south-facing slopes, shading of Douglas-fir seedlings may be desirable. Some competition from vine maple may develop after disturbance. Sites are resistant to the effects of moderate intensity fire. Invasion of non-native species such as Scotch broom (*Cytisus scoparius*) may occur, especially on lower elevation sites.

	Site Index PSME
Mean	165
SE	17
Range	50-472
Age	181
n	21

## Western hemlock/vine maple/swordfern-NWO Cascades

*Tsuga heterophylla/Acer circinatum/Polystichum munitum*-NWO Cascades

TSHE/ACCI/POMU-NWO Cascades

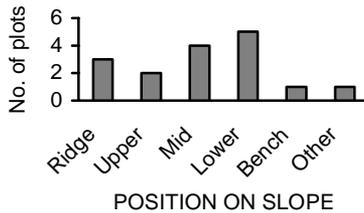
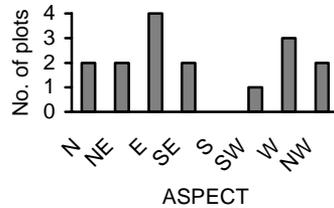
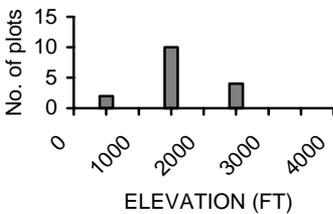
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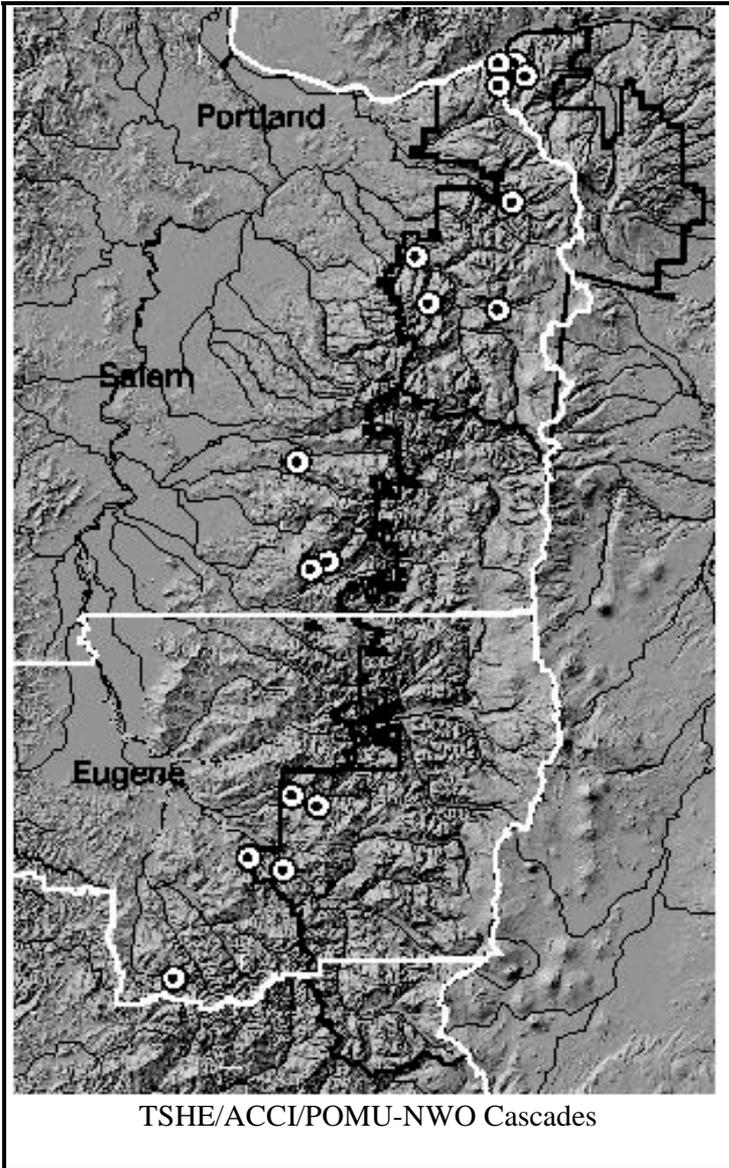
N=16 (MTH=8; WILL=4; EBLM=1; SBLM=3)

### Environment and Distribution

This plant association is primarily in the western portion of the Old Cascades. Plots are located on flat to steep slopes averaging 45% (range 4-75%). Slope positions vary, but lower to mid slope positions are most common. Plots occur on nearly all aspects except south-facing slopes. This association occurs at relatively low elevations, with elevation of plots averaging 1,663 feet (range 700-2,640 ft.).

Soils are well drained and often have high coarse fragment content.





## Vegetation Composition, Structure, and Diversity

The overstory in the TSHE/ACCI/POMU-NWO Cascades association is dominated by Douglas-fir, often with a large component of western hemlock and western redcedar. Canopy closure of mature trees averages 78%. Cover of understory trees averages 5%. This association has a well-developed tall shrub layer, averaging 40% cover. The low shrub layer is relatively sparse with an average cover of only 8%. The shrub layer is dominated by vine maple, which is always present. Other common shrubs include salal, dwarf Oregon grape, and red huckleberry.

Herbaceous cover averages 44%, dominated by swordfern, which is always present. Traces of moist site herbs such as miner's lettuce and starry false Solomon's seal may be associated with local seeps. Moss cover averages 39%.

Common name	Code	Constancy	Cover
<b>Overstory trees</b>			
Douglas-fir	PSME	100	50
Western hemlock	TSHE	94	24
Western redcedar	THPL	44	19
<b>Understory trees</b>			
Western hemlock	TSHE	69	6
<b>Shrubs</b>			
Vine maple	ACCI	100	37
Salal	GASH	94	3
Dwarf Oregon grape	MANE2	88	5
Red huckleberry	VAPA	69	2
Trailing blackberry	RUUR	56	2
<b>Herbaceous</b>			
Swordfern	POMU	100	32
Redwoods violet	WISE3	69	1
Bracken fern	PTAQ	63	2
Pacific trillium	TROV2	63	1
Three-leaved anemone	ANDE3	44	1

TSHE/ACCI/POMU-NWO Cascades averages 136 years old (range 52-250 years). Stands are well stocked, with live basal area averaging 305 ft<sup>2</sup>/acre.

Plots average 20 vascular plant species. This is the lowest value found for western hemlock associations in this portion of the Cascades, but is not significantly below the average species diversity value of 27.

### Management Implications

These tend to be relatively productive forest sites. Douglas-fir grows well with an average site index of 152, well above the 136 average for the western hemlock series in this portion of the Cascades. Some competition from vine maple may develop after disturbance. Sites are resistant to the effect of moderate intensity fire. Invasion of non-native species such as Scotch broom (*Cytisus scoparius*) may occur, especially on lower elevation sites.

This type may occur on steep unstable slopes and may require care in road building. Use of full-suspension should be considered to avoid erosion, compaction and mass movement at these sites.

	Site Index PSME
Mean	152
SE	5
Range	120-190
Age	156
n	18

## Western hemlock/vanilla leaf-NWO Cascades

*Tsuga heterophylla*/*Achlys triphylla*-NWO Cascades

TSHE/ACTR-NWO Cascades

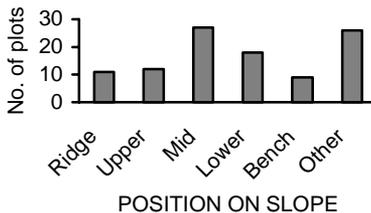
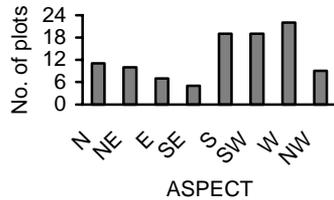
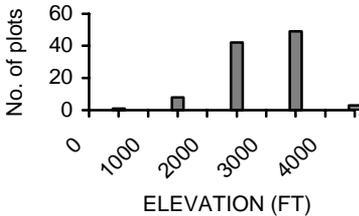
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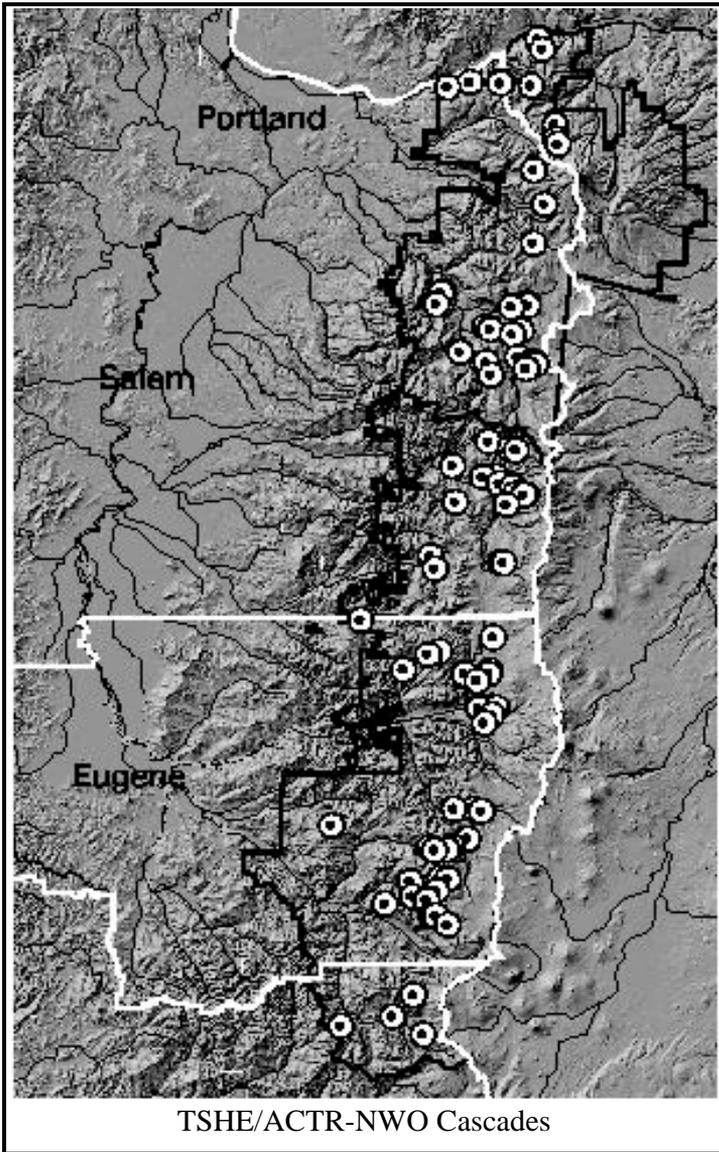
N=103 (MTH=37; WILL=66)

### Environment and Distribution

This widespread plant association occurs on the Mt. Hood and Willamette National Forests. Plot slopes average 23% (range 0-65%) on all slope positions. Warm south to west facing aspects are most common. Plot elevations average 2,902 feet (range 1000-4,600 ft.), relatively high for western hemlock associations.

Soils tend to be deep and well drained, and may have high coarse fragment content.





## Vegetation Composition, Structure, and Diversity

The overstory in the TSHE/ACTR-NWO Cascades association is dominated by Douglas-fir and western hemlock, often with western redcedar. Canopy closure of mature trees averages 77%. Cover of understory trees averages 8%.

This association does not have much of a shrub layer with tall shrubs averaging 15% cover and low shrub cover average of average cover of 12%. Vine maple and dwarf Oregon grape are the predominant shrubs. Other common shrubs include baldhip rose, trailing blackberry, and red huckleberry.

Common name	Code	Constancy	Cover
<b>Overstory trees</b>			
Douglas-fir	PSME	100	51
Western hemlock	TSHE	83	32
Western redcedar	THPL	48	21
<b>Understory trees</b>			
Western hemlock	TSHE	91	7
<b>Shrubs</b>			
Vine maple	ACCI	85	15
Dwarf Oregon grape	MANE2	83	6
Baldhip rose	ROGY	65	2
Trailing blackberry	RUUR	62	1
Red huckleberry	VAPA	52	3
Prince's pine	CHUM	46	5
Trailing snowberry	SYHE	45	3
<b>Herbaceous</b>			
Vanilla leaf	ACTR	89	9
Redwoods violet	WISE3	83	4
Starry false Solomon's seal	MAST4	76	8
Coolwort foamflower	TITR	76	7
Three-leaved anemone	ANDE3	74	2
Twinflower	LIBO3	70	9
Swordfern	POMU	67	4
Pacific trillium	TROV2	67	1
Rattlesnake plantain	GOOB2	65	1
Queencup beadlelily	CLUN2	63	4
Inside-out flower	VAHE	56	4
Pathfinder	ADBI	53	3
Bunchberry dogwood	COCA13	50	7
Sweetscented bedstraw	GATR3	49	1
Wild ginger	ASCA2	47	4

Herbaceous cover averages 39%, with a large variety of herbaceous plants present. Vanilla leaf and redwoods violet are the most common. Other typical herbs include starry false Solomon's seal, coolwort foamflower, and three-leaved anemone. Moss cover averages 35%.

TSHE/ACTR-NWO Cascades stands average 175 years old (range 61-250 years). Stands are well stocked, with live basal area averaging 343 ft<sup>2</sup>/acre.

Plots average 32 vascular plant species, making this association one of the most diverse in the series.

Management Implications

These forest sites are relatively productive. Average site index for Douglas-fir on these sites is 146. The overall average for associations within the western hemlock series in this portion of the Cascades is 136. Dry conditions could occur on steep, south-facing slopes where shading of seedlings may be desirable. Shrub competition from vine maple, and *Ceanothus* after slash burning. Summer frost may occur on flats.

	Site Index ABGR	Site Index PSME
<b>Mean</b>	98	146
<b>SE</b>	7	2.1
<b>Range</b>	80-110	60-217
<b>Age</b>	145	183
<b>n</b>	4	142

## Western hemlock/vanilla leaf-DRY-NWO Cascades

*Tsuga heterophylla*/*Achlys triphylla*-DRY-NWO Cascades

TSHE/ACTR-DRY-NWO Cascades

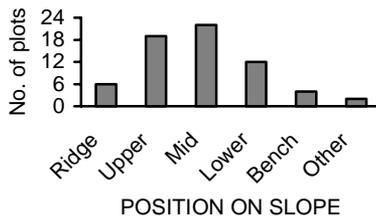
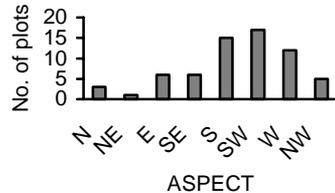
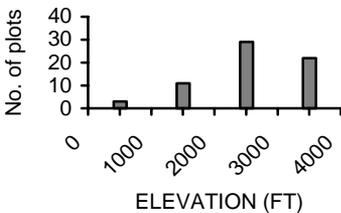
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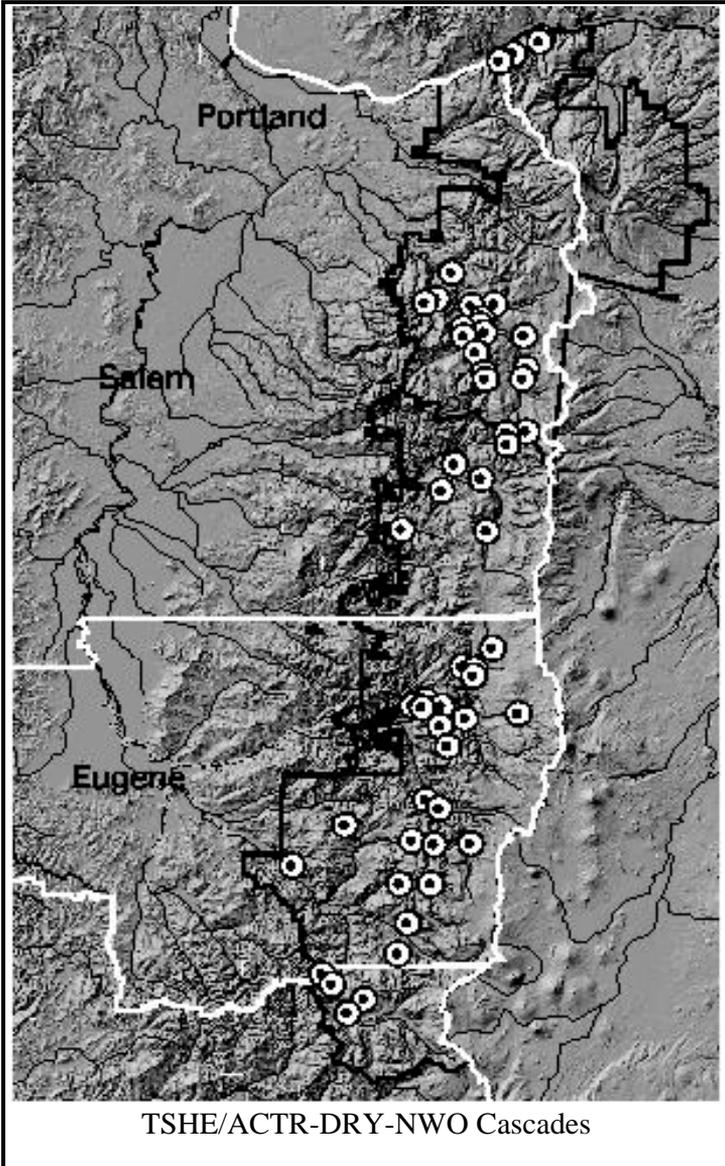
N=64 (MTH=21; WILL=43)

### Environment and Distribution

This plant association occurs throughout the study area. Plots are located on flat to steep slopes averaging 44% (range 0-80%) on warm, south to west facing aspects. Lower to upper slope positions are most common. This association occurs at higher elevations within the Western hemlock zone, with elevations averaging 2,573 feet (range 860-3,850 ft.).

Soils are not shallow, but contain relatively high coarse fragments (generally >40%). The soils have mainly developed over breccia or basalt, and are loams (silt loams, silty clay loams, or fine sandy loams).





## Vegetation Composition, Structure, and Diversity

The overstory in the TSHE/ACTR-DRY-NWO Cascades association is dominated by Douglas-fir and western hemlock. Canopy closure of mature trees averages 72%. Cover of understory trees averages 6%. This association has a moderate tall shrub layer, averaging 28% cover and a well-developed low shrub layer, averaging 40% cover.

Common name	Code	Constancy	Cover
<b>Overstory trees</b>			
Douglas-fir	PSME	100	58
Western hemlock	TSHE	74	20
<b>Understory trees</b>			
Western hemlock	TSHE	77	4
Douglas-fir	PSME	46	2
Pacific dogwood	CONU4	43	9
<b>Shrubs</b>			
Dwarf Oregon grape	MANE2	98	24
Baldhip rose	ROGY	83	3
Vine maple	ACCI	82	22
Trailing blackberry	RUUR	71	2
California hazel	COCO6	63	5
Trailing snowberry	SYHE	63	4
Prince's pine	CHUM	57	4
Red huckleberry	VAPA	52	2
Whipple vine	WHMO	42	6
Oceanspray	HODI	25	5
<b>Herbaceous</b>			
Vanilla leaf	ACTR	98	14
Redwoods violet	WISE3	88	3
Swordfern	POMU	85	6
Three-leaved anemone	ANDE3	80	2
Twinflower	LIBO3	77	10
Star-flower	TRLA6	75	2
Pathfinder	ADBI	74	3
White hawkweed	HIAL2	66	1
Rattlesnake plantain	GOOB2	65	1
Sweetscented bedstraw	GATR3	58	1
Inside-out-flower	VAHE	57	3
Scouler's harebell	CASC7	51	2
Big leaf sandwort	ARMA18	45	1
Hooker fairybells	DIHO3	45	1
Bracken fern	PTAQ	45	3

The TSHE/ACTR-DRY-NWO Cascades association is characterized by  $\geq 5\%$  cover of vanilla leaf and  $> 10\%$  cover of dry site shrubs and forbs. Common dry site shrubs include California hazel, whipplevine, oceanspray, and thimbleberry. Dry site forbs include star-flower, pathfinder, white hawkweed, big leaf sandwort, wild strawberry, sweet cicely, wall lettuce, snow queen, leafy pea vine, and yerba buena. Herbaceous cover averages 34%. Moss cover averages 35%.

Stands in the TSHE/ACTR-DRY-NWO Cascades plant association average 186 years (range 61-250 years). Stands are well stocked, with live basal area averaging 326 ft<sup>2</sup>/acre.

Plots average 34 vascular plant species, making it the most diverse in the western hemlock series for this portion of the Cascades.

Management Implications

Site productivity in the TSHE/ACTR-DRY-NWO Cascades association is moderate, with an average Douglas-fir site index of 133, near the 136 mean for the western hemlock series.

	Site Index PSME	Site Index TSHE
<b>Mean</b>	133	132
<b>SE</b>	3	4
<b>Range</b>	81-190	122-139
<b>Age</b>	200	203
<b>n</b>	87	4

## Western hemlock/dwarf Oregon grape-NWO Cascades

*Tsuga heterophylla*/*Mahonia nervosa*-NWO Cascades

TSHE/MANE2-NWO Cascades

(old code: TSHE/BENE)

CHS161

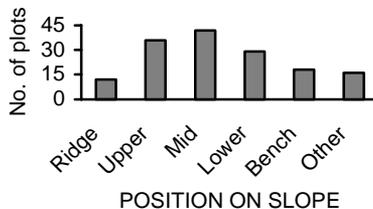
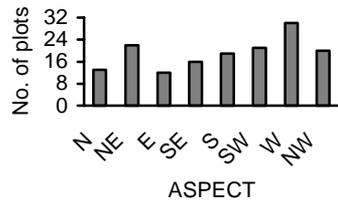
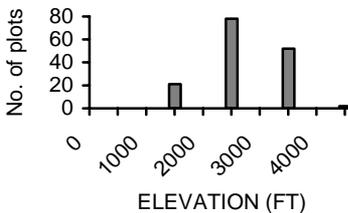
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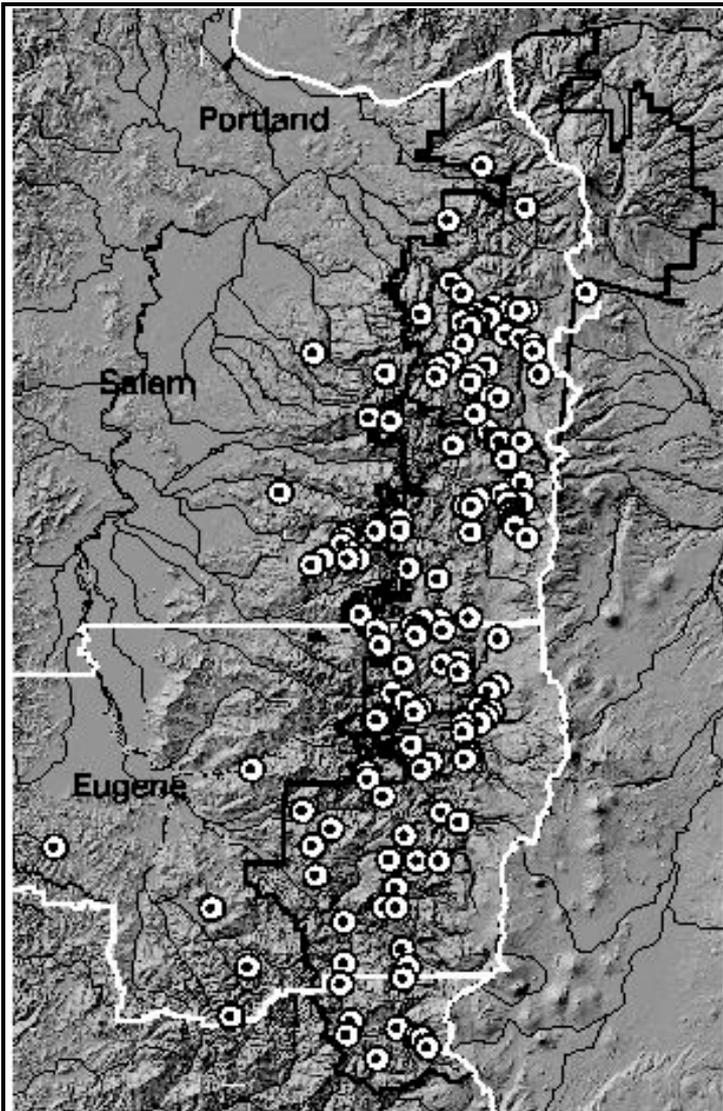
### Environment and Distribution

The TSHE/MANE2-NWO Cascades association is one of the most common associations in the westside Cascades. This association occurs on warm, well-drained, moderately productive sites. A similar but warmer and slightly drier type has been placed into a different association, TSHE/MANE2-DRY-NWO Cascades.

Plots are on moderate to steep slopes, averaging 35% (range 0-90%). They are found on all slope positions, primarily on lower to upper slopes. Aspects vary. This association occurs at mid elevations, with elevation of plots averaging 2,679 feet (range 1,000-4,000 ft.).

Soils are moderately deep and well drained. They may be rocky or gravelly.





TSHE/MANE2-NWO Cascades

## Vegetation Composition, Structure, and Diversity

The overstory in the TSHE/MANE2-NWO Cascades association is dominated by Douglas-fir and western hemlock, often with western redcedar. Canopy closure of mature trees averages 81%. Cover of understory trees averages 9%. This association has a sparse to moderate shrub layer, with tall shrubs averaging 14% cover and low shrubs 26% cover. Dwarf Oregon grape is the predominant shrub species. Vine maple and red huckleberry are often present. Rhododendron may be present, but is less than 10% cover.

Common name	Code	Constancy	Cover
<b>Overstory trees</b>			
Douglas-fir	PSME	100	44
Western hemlock	TSHE	93	40
Western redcedar	THPL	62	19
<b>Understory trees</b>			
Western hemlock	TSHE	89	8
Western redcedar	THPL	50	5
<b>Shrubs</b>			
Dwarf Oregon grape	MANE2	99	22
Vine maple	ACCI	74	15
Red huckleberry	VAPA	72	2
Trailing blackberry	RUUR	62	1
Little prince's pine	CHME	53	1
Salal	GASH	50	3
Rhododendron	RHMA3	48	4
Prince's pine	CHUM	45	3
<b>Herbaceous</b>			
Redwoods violet	WISE3	75	2
Twinflower	LIBO3	74	9
Swordfern	POMU	68	3
Pacific trillium	TROV2	56	1
Rattlesnake plantain	GOOB2	55	1
Three-leaved anemone	ANDE3	50	1
Vanilla leaf	ACTR	46	1

The TSHE/MANE2-NWO Cascades association is a very herb-poor type. Herbaceous cover averages 14%. The herbaceous layer may have a fair amount of twinflower, but only trace amounts of other herbs, such as redwoods violet or swordfern. Moss cover averages 43%.

Stands in the TSHE/MANE2-NWO Cascades plant association average 191 years (range 60-390 years). Stands are moderately stocked, with live basal area averaging 265 ft<sup>2</sup>/acre.

Plots average 25 vascular plant species, about the mean for the western hemlock series.

### Management Implications

These are moderately productive forest sites, with an average Douglas-fir site index of 131. Moderate site conditions and competition levels usually enable successful conifer establishment after disturbance. Ability to plant may be restricted on some TSHE/MANE2-NWO Cascades sites, due to rocky soils.

Vine maple or snowbrush (*Ceanothus velutinus*) may present competition problems if seedlings are not established quickly. Soils are generally rich and deep enough to retain site productivity after fires of moderate intensity. Some sites may respond to fertilization.

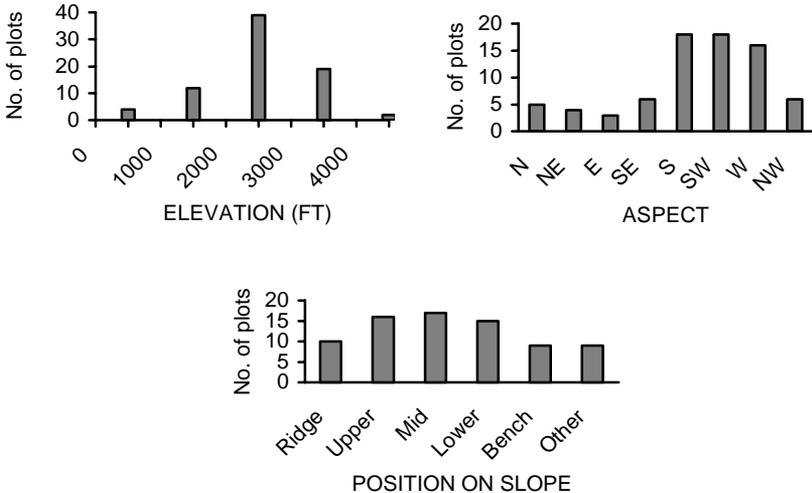
	Site Index PSME	Site Index TSHE
<b>Mean</b>	131	114
<b>SE</b>	2	5
<b>Range</b>	75-200	50-151
<b>Age</b>	227	153
<b>n</b>	183	19

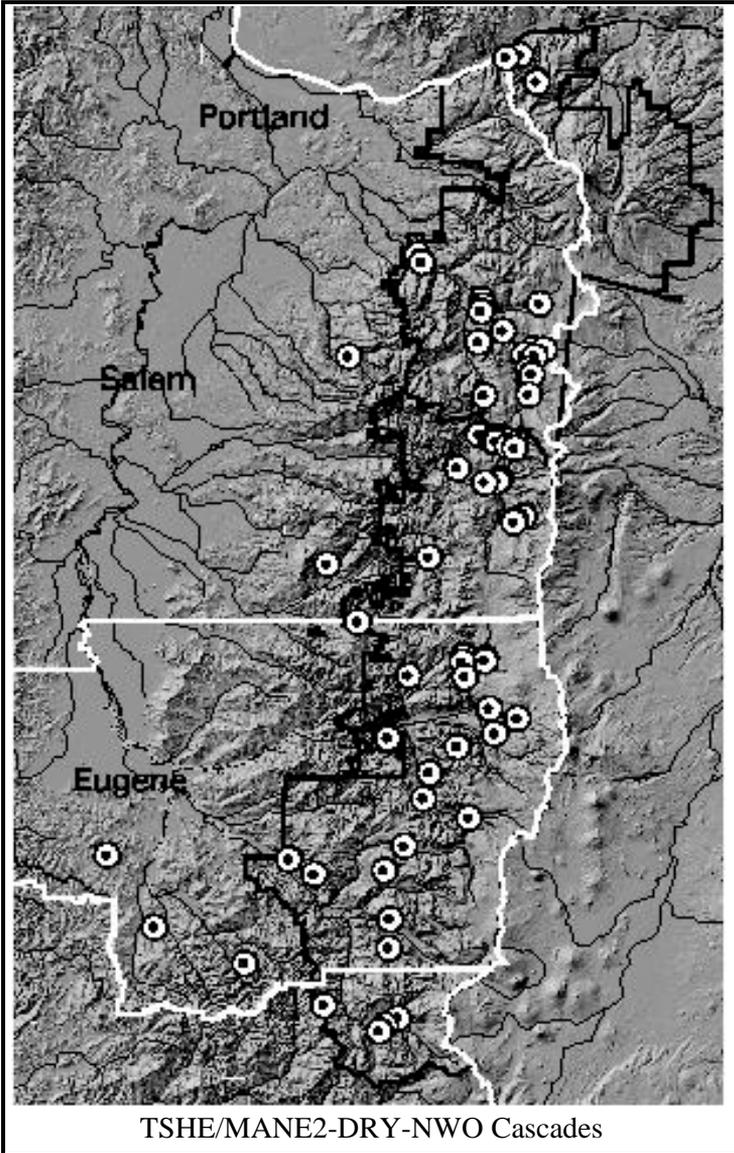
**Western hemlock/dwarf Oregon grape-DRY-NWO Cascades**  
*Tsuga heterophylla/Mahonia nervosa-DRY-NWO Cascades*  
 TSHE/MANE2-DRY-NWO Cascades  
 N=79 (MTH=29; WILL=45; EBLM=3; SBLM=2)

Environment and Distribution

This plant association occurs throughout the westside Cascades. Plots are on flat to steep slopes, averaging 40% (range 0-85%). Slope positions vary. Warm south to west aspects are most common. This association occurs at a wide range of elevations, but primarily at mid elevations. Plots average 2,530 feet (range 650-4,100 ft.).

The TSHE/MANE2-DRY-NWO Cascades association occurs on drier sites, often with rocky or gravelly soils.





## Vegetation Composition, Structure, and Diversity

The overstory in the TSHE/MANE2-DRY-NWO Cascades association is dominated by Douglas-fir and western hemlock. Golden chinquapin is frequently present in the understory. Canopy closure of mature trees averages 75%. Cover of understory trees averages 8%. This association has a moderately well developed shrub layer, with tall shrubs averaging 29% cover and low shrubs averaging 34% cover.

Common name	Code	Constancy	Cover
<b>Overstory trees</b>			
Douglas-fir	PSME	100	58
Western hemlock	TSHE	80	25
<b>Understory trees</b>			
Western hemlock	TSHE	86	7
Golden chinquapin	CHCH7	41	2
<b>Shrubs</b>			
Dwarf Oregon grape	MANE2	100	28
Baldhip rose	ROGY	89	3
Vine maple	ACCI	86	27
Trailing blackberry	RUUR	77	2
Trailing snowberry	SYHE	75	4
California hazel	COCO6	71	3
Red huckleberry	VAPA	52	2
Prince's pine	CHUM	46	4
Little prince's pine	CHME	46	2
Oceanspray	HODI	30	4
<b>Herbaceous</b>			
Twinflower	LIBO3	72	8
Swordfern	POMU	70	4
Star-flower	TRLA6	70	2
Three-leaved anemone	ANDE3	67	2
Redwoods violet	WISE3	59	4
Vanilla leaf	ACTR	57	2
Rattlesnake plantain	GOOB2	56	1
Pacific trillium	TROV2	52	1
Sweetscented bedstraw	GATR3	47	1
Inside-out flower	VAHE	47	2
Pathfinder	ADBI	46	2

Dwarf Oregon grape and vine maple are the predominant shrubs. The TSHE/MANE2-DRY-NWO Cascades association is characterized by the presence of numerous dry site shrubs, including California hazel, oceanspray, trailing snowberry, thimbleberry, serviceberry, and poison oak.

Herbaceous cover is relatively low, averaging 20%. Twinflower is the predominant herbaceous species. Moss cover averages 38%.

Stands in the TSHE/MANE2-DRY-NWO Cascades plant association average 153 years (range 53-250 years). Stands are moderately stocked, with live basal area averaging 274 ft<sup>2</sup>/acre.

Plots average 32 vascular plant species, making it one the most diverse in the western hemlock series.

### Management Implications

These are moderately productive forest sites, with an average Douglas-fir site index of 131. This variant of the TSHE/MANE2-NWO Cascades association reflects warmer, drier conditions, but the considerations are not very different. Seedlings should be shaded on southerly aspects to aid survival. Ability to plant may be restricted, due to the high rock content on many of the sites. Shallow soils may be encountered more frequently and burning plans should be adjusted to avoid duff consumption and site productivity losses.

	Site Index PSME	Site Index TSHE
<b>Mean</b>	131	119
<b>SE</b>	2	6
<b>Range</b>	75-192	90-138
<b>Age</b>	155	122
<b>n</b>	107	7

## Western hemlock/dwarf Oregon grape-salal-NWO Cascades

*Tsuga heterophylla/Mahonia nervosa-Gaultheria shallon*

TSHE/MANE2-GASH-NWO Cascades

(old code: TSHE/BENE-GASH)

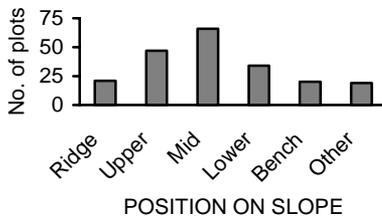
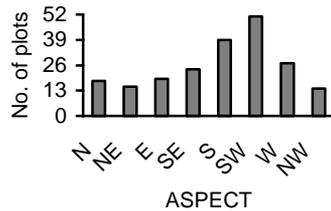
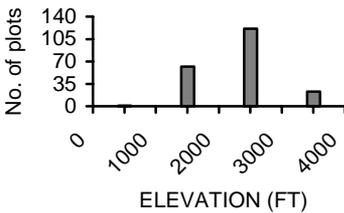
CHS160

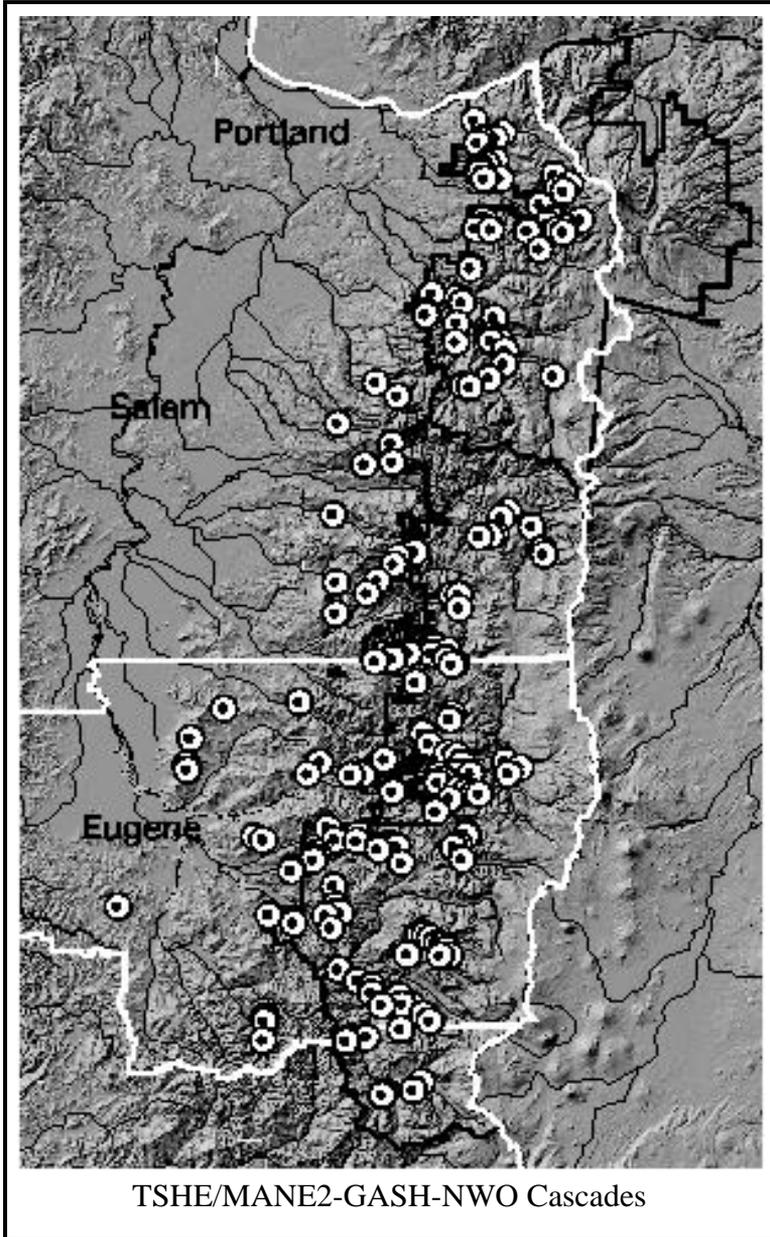
N=207 (MTH=59; WILL=117; EBLM=18; SBLM=13)

### Environment and Distribution

This common plant association occurs throughout the westside Cascades. It is found on moderately warm and dry sites within the western hemlock zone on well-drained soils, in the middle of the gradient from more mesic conditions in TSHE/MANE2-NWO Cascades and drier conditions in TSHE/GASH-NWO Cascades. It is generally found at low to mid elevations (average 2,280 ft., range 905-3,640 ft.) on mid to upper slope positions. Plots are located on moderate to steep slopes averaging 36% (range 0-80%). Aspects vary, but warm south- to west-facing slopes are typical.

Soils tend to be relatively deep and fine-textured, but may have high coarse fragment content. In some cases, the presence of this association may be related to ground disturbance.





## Vegetation Composition, Structure, and Diversity

The overstory in the TSHE/MANE2-GASH-NWO Cascades association is dominated by Douglas-fir and western hemlock, frequently with a component of western redcedar. Canopy closure of mature trees averages 74%. Cover of understory trees averages 7%. This association has a well-developed shrub layer, with tall shrubs averaging 23% cover and low shrubs averaging 52% cover. A dense shrub cover can often develop in canopy openings. Dwarf Oregon grape and salal are the predominant shrubs, and both are always present. Other common shrubs include vine maple, red huckleberry and trailing blackberry.

Common name	Code	Constancy	Cover
<b>Overstory trees</b>			
Douglas-fir	PSME	99	50
Western hemlock	TSHE	80	28
Western redcedar	THPL	46	14
<b>Understory trees</b>			
Western hemlock	TSHE	88	6
<b>Shrubs</b>			
Dwarf Oregon grape	MANE2	100	26
Salal	GASH	100	30
Vine maple	ACCI	86	20
Red huckleberry	VAPA	84	3
Trailing blackberry	RUUR	81	1
Baldhip rose	ROGY	50	1
Rhododendron	RHMA3	43	4
<b>Herbaceous</b>			
Swordfern	POMU	87	8
Redwoods violet	WISE3	69	2
Twinflower	LIBO3	60	7
Pacific trillium	TROV2	59	1
Three-leaved anemone	ANDE3	51	1
Bracken fern	PTAQ	47	2
Sweetscented bedstraw	GATR3	42	1
Vanilla leaf	ACTR	40	1

The herbaceous layer is sparse, with an average cover of 17%. Swordfern is the predominant herb. Redwoods violet and twinflower are also frequently present. Moss cover averages 32%.

Stands in the TSHE/MANE2-GASH-NWO Cascades association average 157 years, ranging from 47 to 362 years old. Stands are well stocked, with live basal area averaging 285 ft<sup>2</sup>/acre.

Plots average 27 vascular plant species, about the mean for the western hemlock series.

### Management Implications

These are moderately productive forest sites, with an average Douglas-fir site index of 137. Shrub competition is usually not a problem if seedlings are established quickly after disturbance. Soils are resistant to productivity loss from moderate intensity fire effects.

Snowbrush (*Ceanothus velutinus*) may germinate and occupy the site following fire. Sites with shallow or clay soils should be burned at lower intensities to protect the duff layer and soils.

	Site Index PSME	Site Index TSHE
<b>Mean</b>	137	134
<b>SE</b>	1	4
<b>Range</b>	60-210	58-207
<b>Age</b>	163	125
<b>n</b>	397	48

**Western hemlock/dwarf Oregon grape-salal-DRY-NWO  
Cascades**

*Tsuga heterophylla/Mahonia nervosa-Gaultheria shallon-DRY*

TSHE/MANE2-GASH-DRY-NWO Cascades

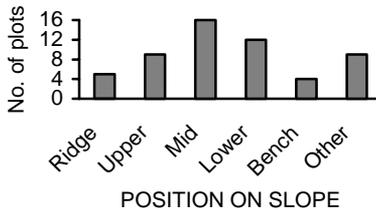
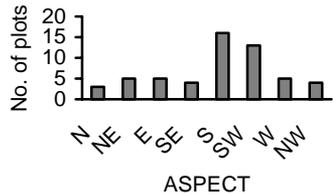
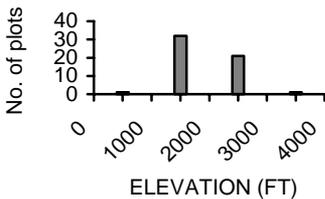
CHS159

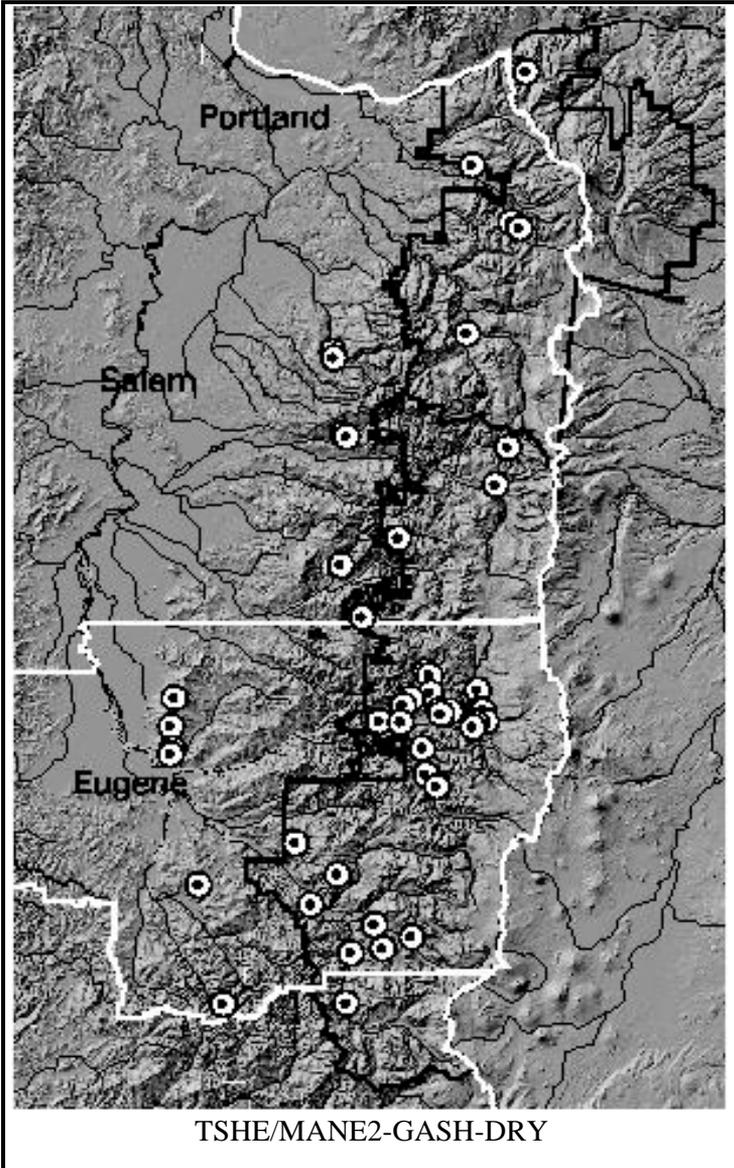
N=55 (MTH=4; WILL=39; EBLM=6; SBLM=6)

Environment and Distribution

This plant association occurs throughout the westside Cascades. It is found on moderately warm and dry sites within the western hemlock zone. This variant of the TSHE/MANE2-GASH-NWO Cascades association is dominated by dry-site shrubs such as dwarf Oregon grape and salal, particularly within open canopy areas. The TSHE/MANE2-GASH-DRY-NWO Cascades association is generally found at low to moderate elevations (average 1,907 ft., range 850-3,800 ft.), on south-facing slopes. Plots are located on moderate to steep slopes averaging 39% (range 0-90%).

Soils are well drained and may be rockier than those in the TSHE/MANE2-GASH-NWO Cascades.





## Vegetation Composition, Structure, and Diversity

The overstory in the TSHE/MANE2-GASH-DRY-NWO Cascades association is dominated by Douglas-fir, often with a large component of western hemlock, big-leaf maple, and western redcedar. Canopy closure of mature trees averages 74%. Cover of understory trees averages 5%.

Common name	Code	Constancy	Cover
<b>Overstory trees</b>			
Douglas-fir	PSME	100	56
Western hemlock	TSHE	75	17
Big-leaf maple	ACMA3	56	12
Western redcedar	THPL	51	13
<b>Understory trees</b>			
Western hemlock	TSHE	71	8
Pacific dogwood	CONU4	58	6
Douglas-fir	PSME	47	3
<b>Shrubs</b>			
Salal	GASH	100	34
Dwarf Oregon grape	MANE2	98	27
California hazel	COCO6	91	9
Trailing blackberry	RUUR	91	2
Vine maple	ACCI	89	28
Baldhip rose	ROGY	82	1
Red huckleberry	VAPA	73	3
Trailing snowberry	SYHE	42	2
Whipplevine	WHMO	35	4
Oceanspray	HODI	27	4
<b>Herbaceous</b>			
Swordfern	POMU	91	13
Redwoods violet	WISE3	78	3
Three-leaved anemone	ANDE3	76	1
Twinflower	LIBO3	69	10
Vanilla leaf	ACTR	65	1
Pathfinder	ADBI	62	1
Sweetscented bedstraw	GATR3	60	1
Star-flower	TRLA6	60	2
Inside-out flower	VAHE	55	1
Bracken fern	PTAQ	51	3

This association has a well-developed shrub layer, with tall shrubs averaging 38% cover and low shrubs averaging 60% cover. Salal, dwarf Oregon grape, and vine maple are the predominant shrubs. On some sites, dwarf Oregon grape may be minor or absent. The TSHE/MANE2-GASH-DRY-NWO Cascades association has numerous dry site shrubs, including California hazel, oceanspray, trailing snowberry, whipplevine, thimbleberry, serviceberry, or poison oak.

Herbaceous cover averages 25%. Swordfern and twinflower are the dominant forbs. Redwoods violet and three-leaved anemone are frequently present. Moss cover averages 42%.

Stands in the TSHE/MANE2-GASH-DRY-NWO Cascades association average 159 years (range 64-388 years). Stands had relatively low stocking, with live basal area averaging 229 ft<sup>2</sup>/acre.

Plots average 31 vascular plant species, high for the western hemlock series, and more similar to the diverse grand fir and Douglas-fir series.

Management Implications

These are moderately productive forest sites, with an average Douglas-fir site index of 138. This variant of TSHE/MANE2-GASH-NWO Cascades indicates warmer, drier conditions. Site productivity is essentially the same. Soils are resistant to fire of moderate intensity. Snowbrush (*Ceanothus velutinus*) may germinate and compete with seedlings following fire.

	Site Index PSME	Site Index TSHE
<b>Mean</b>	138	120
<b>SE</b>	3	9
<b>Range</b>	58-231	90-140
<b>Age</b>	162	115
<b>n</b>	102	5

## Western hemlock/dwarf Oregon grape/vanilla leaf

*Tsuga heterophylla*/*Mahonia nervosa*/*Achlys triphylla*

TSHE/MANE2/ACTR

(old code: TSHE/BENE/ACTR)

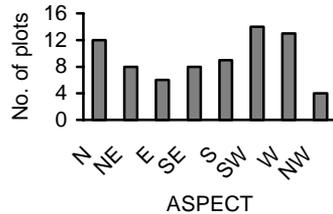
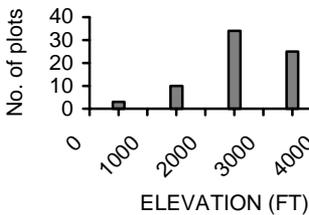
CHS162

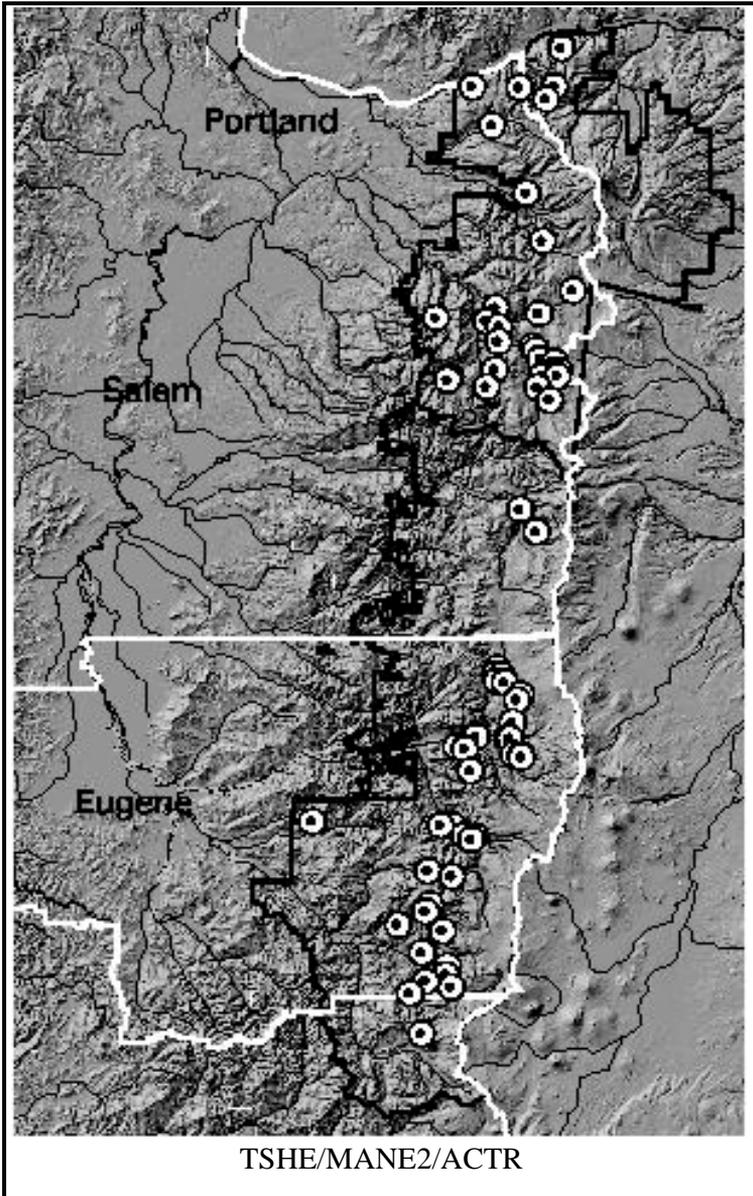
N=74 (MTH=33; WILL=41)

### Environment and Distribution

This plant association occurs throughout the westside Cascades. Plots are located on slopes averaging 27% (range 0-85%). They are found on all slope positions, primarily on mid to upper slopes. Plots occur on all aspects. Elevation of plots averages 2,698 feet (range 1,140-4,700 ft.).

Soils are usually relatively deep and well drained.





## Vegetation Composition, Structure, and Diversity

The overstory in the TSHE/MANE2/ACTR association is dominated by Douglas-fir, often with a large component of western hemlock, and western redcedar. Canopy closure of mature trees averages 77%. Cover of understory trees averages 8%.

Common name	Code	Constancy	Cover
<b>Overstory trees</b>			
Douglas-fir	PSME	99	56
Western hemlock	TSHE	88	26
Western redcedar	THPL	45	17
<b>Understory trees</b>			
Western hemlock	TSHE	87	8
<b>Shrubs</b>			
Dwarf Oregon grape	MANE2	97	37
Vine maple	ACCI	85	23
Baldhip rose	ROGY	79	3
Trailing blackberry	RUUR	77	2
Red huckleberry	VAPA	55	2
Trailing snowberry	SYHE	44	2
Prince's pine	CHUM	41	5
<b>Herbaceous</b>			
Vanilla leaf	ACTR	85	10
Three-leaved anemone	ANDE3	83	2
Redwoods violet	WISE3	81	4
Twinflower	LIBO3	71	8
Swordfern	POMU	69	9
Starry false Solomon's seal	MAST4	64	4
Pacific trillium	TROV2	63	1
Coolwort foamflower	TITR	60	5
Rattlesnake plantain	GOOB2	55	1
Inside-out flower	VAHE	55	3
Pathfinder	ADBI	53	2
Hooker fairybells	DIHO3	53	1
Queencup beadlily	CLUN2	51	3
Star-flower	TRLA6	51	2
Wild ginger	ASCA2	43	3
Bunchberry dogwood	COCA13	40	7

This association has a moderately well developed shrub layer, with tall shrubs averaging 22% cover and low shrubs averaging 42% cover. Dwarf Oregon grape and vine maple are the predominant shrubs. Other common shrubs include trailing blackberry and baldhip rose.

The herb layer is dominated by vanilla leaf, often with a significant component of swordfern. A diverse array of other forbs occurs in lower amounts. Herbaceous cover averages 36%. Moss cover averages 42%.

Stands in the TSHE/MANE2/ACTR association average 182 years, ranging from 56 to 295 years old. Stands have high stocking, with live basal area averaging 371 ft<sup>2</sup>/acre.

Plots average 30 vascular plant species, slightly higher than the mean for the western hemlock series.

Management Implications

These are productive forest sites, with an average Douglas-fir site index of 145. Regeneration can be difficult in areas with rocky soils, or at higher elevations near 4000 feet where growing season frost should be expected on flat terrain or frost pockets. Competition from shrubs may be a problem, especially snowbrush (*Ceanothus velutinus*) on burned sites. Gophers may damage seedlings on some sites.

	Site Index PSME	Site Index TSHE
<b>Mean</b>	145	150
<b>SE</b>	2	7
<b>Range</b>	89-200	132-163
<b>Age</b>	204	135
<b>n</b>	111	4

# Western hemlock/dwarf Oregon grape/Oregon oxalis-NWO Cascades

*Tsuga heterophylla/Mahonia nervosa/Oxalis oregana*

TSHE/MANE2/OXOR-NWO Cascades

(old code: TSHE/BENE/OXOR)

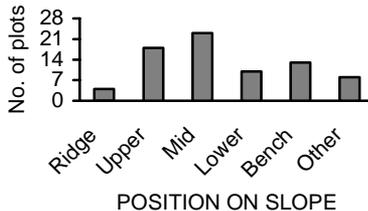
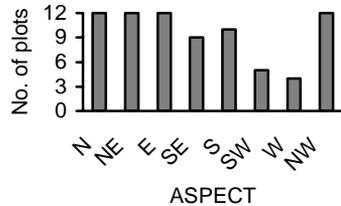
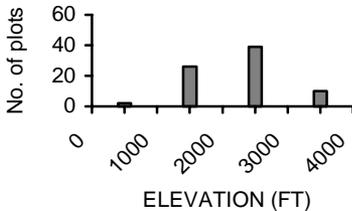
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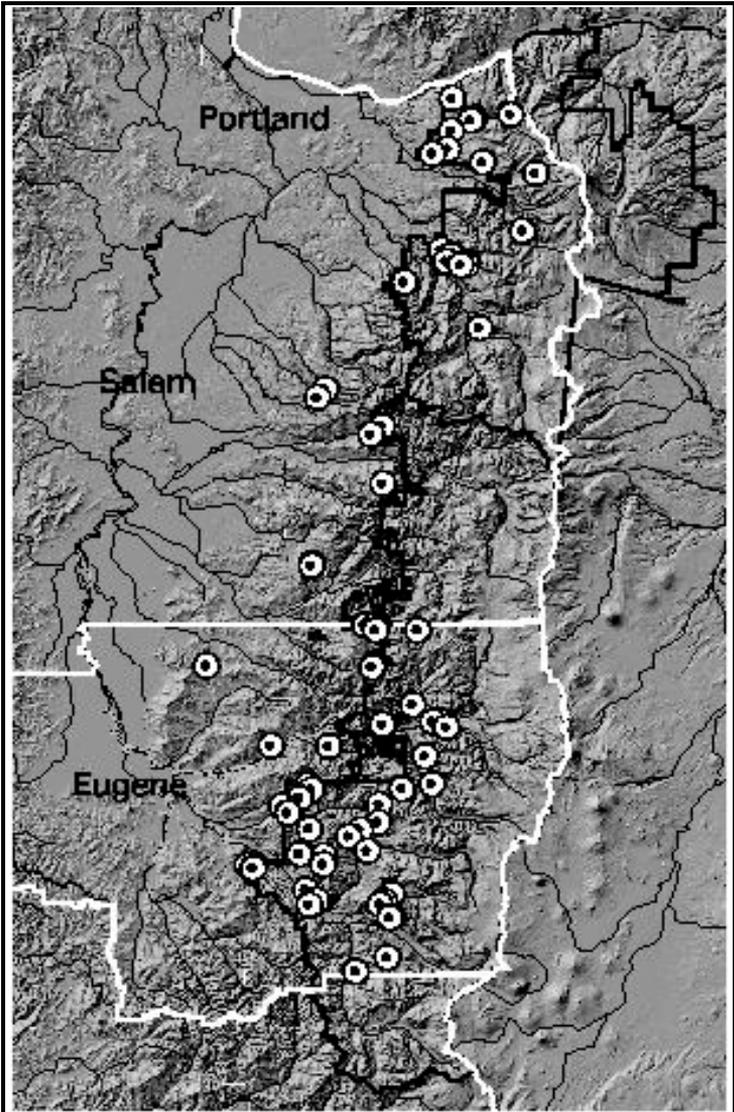
N=77 (MTH=19; WILL=46; EBLM=6; SBLM=6)

## Environment and Distribution

This plant association occurs throughout the western margin of the Cascades. Plots are located on slopes averaging 34% (range 0-91%). They are found on all slope positions, primarily on mid to upper slopes. Plots occur on all aspects, although are less likely to be found on southwest or west-facing slopes. Elevation of plots averages 2,254 feet (range 900-3,920 ft.).

Soils are relatively deep and well drained but also well watered.





TSHE/MANE2/OXOR-NWO Cascades

## Vegetation Composition, Structure, and Diversity

The overstory in the TSHE/MANE2/OXOR-NWO Cascades association is dominated by Douglas-fir, often with a large component of western hemlock and western redcedar. Canopy closure of mature trees averages 75%. Cover of understory trees averages 8%.

This association has a moderately well developed shrub layer, with tall shrubs averaging 21% cover and low shrubs averaging 40% cover. Dwarf Oregon grape and vine maple are the predominant shrubs. Other common shrubs include salal, red huckleberry, and trailing blackberry.

Common name	Code	Constancy	Cover
<b>Overstory trees</b>			
Douglas-fir	PSME	99	49
Western hemlock	TSHE	88	33
Western redcedar	THPL	51	11
<b>Understory trees</b>			
Western hemlock	TSHE	94	9
Western redcedar	THPL	34	5
<b>Shrubs</b>			
Dwarf Oregon grape	MANE2	100	33
Red huckleberry	VAPA	87	3
Vine maple	ACCI	82	22
Salal	GASH	71	12
Trailing blackberry	RUUR	64	2
<b>Herbaceous</b>			
Oregon oxalis	OXOR	100	36
Swordfern	POMU	99	18
Redwoods violet	WISE3	61	2
Pacific trillium	TROV2	55	1
Vanilla leaf	ACTR	53	5
Sweetscented bedstraw	GATR3	52	1
Hooker fairybell	DIHO3	48	1
Inside-out-flower	VAHE	45	3
Twinflower	LIBO3	44	7
Bracken fern	PTAQ	42	4

The herb layer, dominated by Oregon oxalis and swordfern, is typical of relatively moist sites. Herbaceous cover averages 54%. Moss cover averages 33%.

Stands in the TSHE/MANE2/OXOR-NWO Cascades association average 180 years (range 64-410 years). Stands are well stocked, with live basal area averaging 296 ft<sup>2</sup>/acre.

Plots average 25 vascular plant species, about the mean for the western hemlock series in the Cascades.

### Management Implications

These are productive forest sites, with an average site index of 155. Many sites have moist soils well into the growing season. Tree seedling establishment should not be difficult. Soils should be resistant to effects from moderate intensity fires.

	Site Index PSME	Site Index TSHE
<b>Mean</b>	155	137
<b>SE</b>	2	3
<b>Range</b>	110-200	76-169
<b>Age</b>	228	170
<b>n</b>	146	31

**Western hemlock/dwarf Oregon grape/swordfern-NWO Cascades**

*Tsuga heterophylla/Mahonia nervosa/Polystichum munitum*

TSHE/MANE2/POMU-NWO Cascades

(old code: TSHE/BENE/POMU)

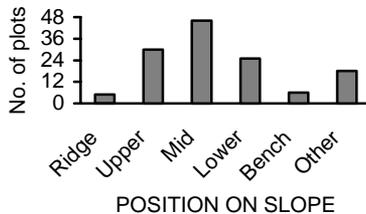
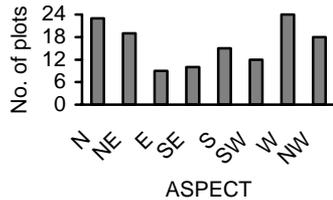
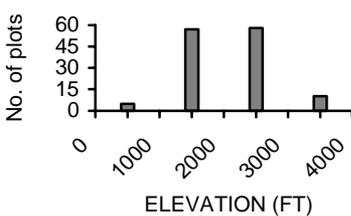
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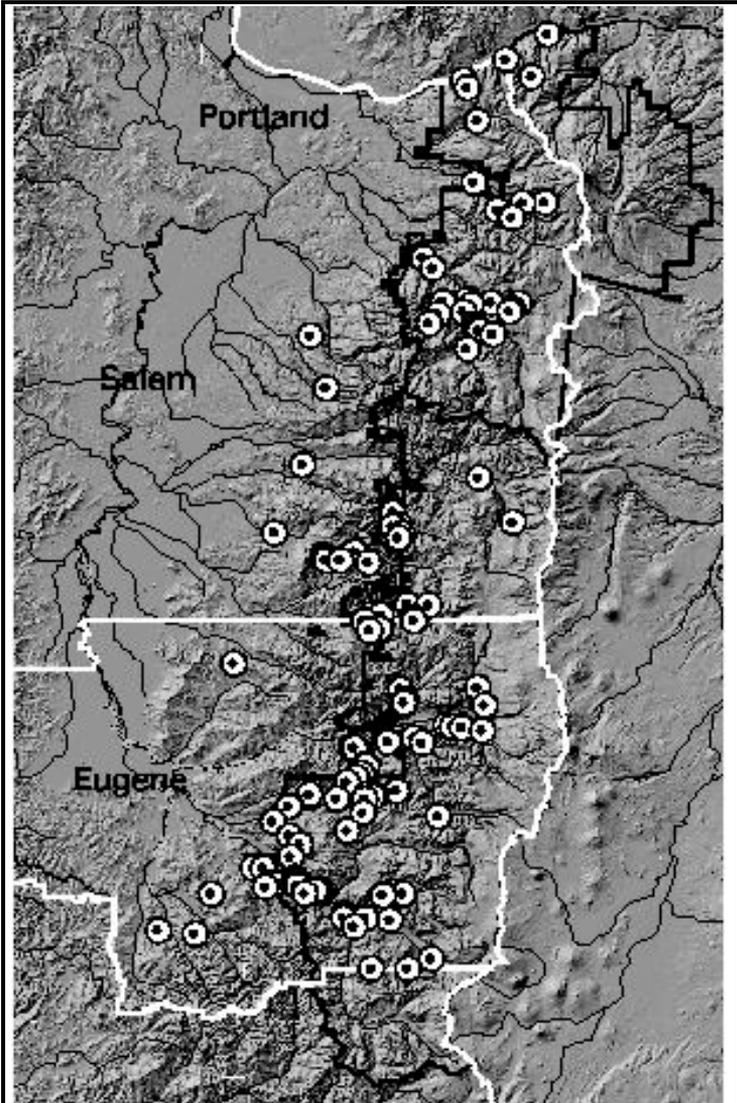
N=130 (MTH=32; WILL=75; EBLM=9; SBLM=14)

Environment and Distribution

This common plant association occurs throughout the Old Cascades. Plots are located on flat to steep slopes averaging 48% (range 0-90%). They are found on all slope positions, primarily on lower to upper slopes, and on all aspects, most commonly on north and west-facing slopes. This type occurs at mid-elevations in the western hemlock zone, with an average of 2,047 feet (range 190-3,980 ft.).

This type is slightly moister than the TSHE/MANE2-NWO Cascades type. Soils are well drained.





TSHE/MANE2/POMU-NWO Cascades

## Vegetation Composition, Structure, and Diversity

The overstory in the TSHE/MANE2/POMU-NWO Cascades association is dominated by Douglas-fir and western hemlock, often with a large component of western redcedar and big-leaf maple. Canopy closure of mature trees averages 79%. Cover of understory trees averages 6%.

This association has a moderately well developed shrub layer, with tall shrubs averaging 23% cover and low shrubs averaging 30% cover. Dwarf Oregon grape and vine maple are the dominant shrubs. Other common shrubs include red huckleberry, trailing blackberry, and salal. The herb layer averages 30% cover, dominated by swordfern. Moss cover averages 38%.

Common name	Code	Constancy	Cover
<b>Overstory trees</b>			
Douglas-fir	PSME	98	47
Western hemlock	TSHE	88	36
Big-leaf maple	ACMA3	53	13
Western redcedar	THPL	50	20
<b>Understory trees</b>			
Western hemlock	TSHE	88	7
Western redcedar	THPL	40	4
<b>Shrubs</b>			
Dwarf Oregon grape	MANE2	100	27
Vine maple	ACCI	81	23
Red huckleberry	VAPA	78	2
Trailing blackberry	RUUR	71	1
Salal	GASH	65	4
<b>Forbs</b>			
Swordfern	POMU	100	23
Pacific trillium	TROV2	74	1
Redwoods violet	VISE3	68	2
Three-leaved anemone	ANDE3	56	1
Vanilla leaf	ACTR	52	2
Sweetscented bedstraw	GATR3	52	1
Twinflower	LIBO3	51	4
Inside-out-flower	VAHE	50	1

TSHE/MANE2/POMU-NWO Cascades stands average 175 years (range 58-300 years). Stands are well stocked, with live basal area averaging 302 ft<sup>2</sup>/acre.

Plots average 25 vascular plant species, which is about the mean for the series in the Cascades.

### Management Implications

These are moderately productive forest sites, with an average Douglas-fir site index of 141. Potential problems may result from the steep and somewhat unstable slopes that frequently occur in this type. Shrub competition should be moderate on most sites. Areas with shallow soils should be burned at lower intensities to maintain site productivity.

	Site Index PSME	Site Index TSHE
<b>Mean</b>	141	130
<b>SE</b>	2	6
<b>Range</b>	60-210	90-200
<b>Age</b>	216	139
<b>n</b>	164	19

## Western hemlock/salal-NWO Cascades

*Tsuga heterophylla*/*Gaultheria shallon*-NWO Cascades

TSHE/GASH-NWO Cascades

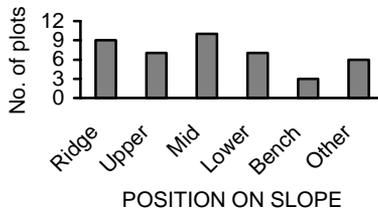
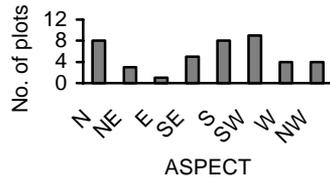
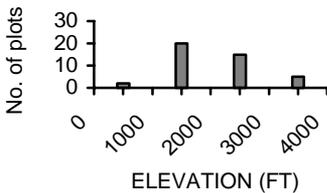
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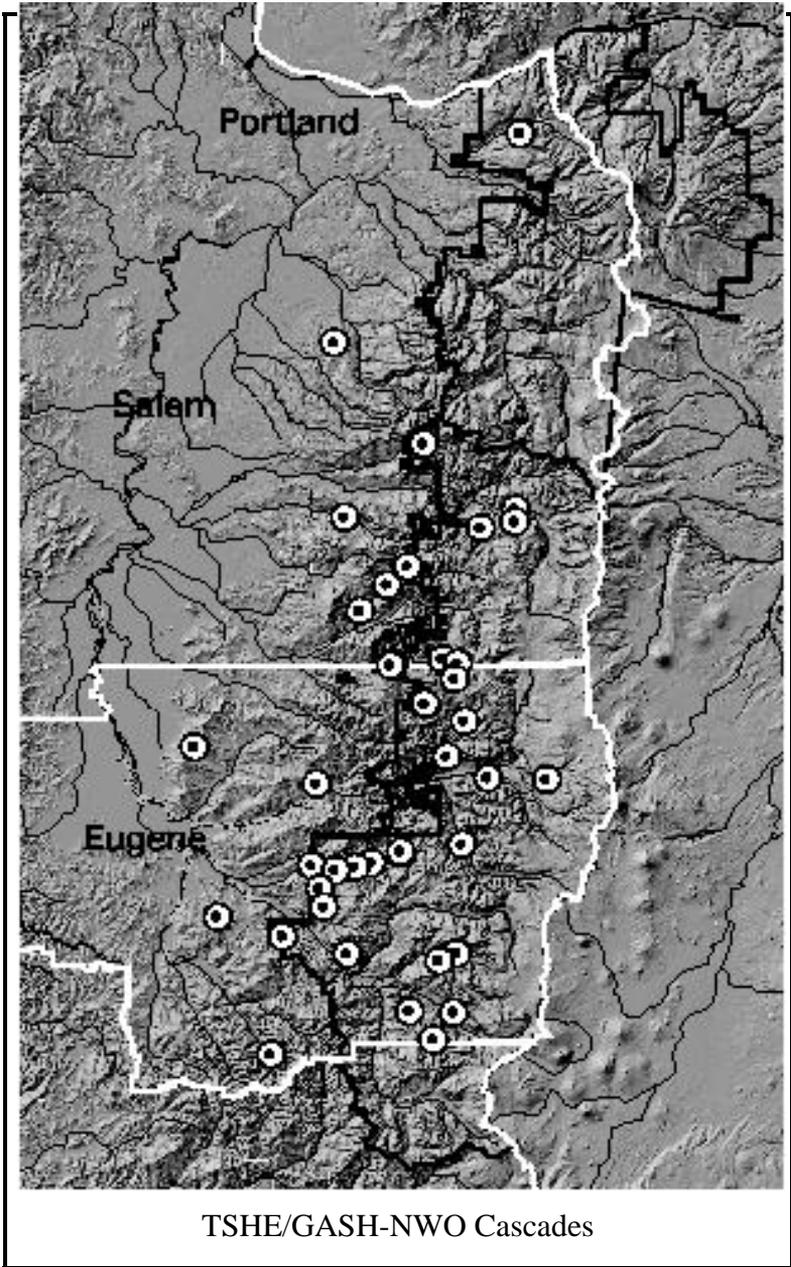
N=42 (MTH=1; WILL=30; EBLM=5; SBLM=6)

### Environment and Distribution

TSHE/GASH-NWO Cascades occurs primarily in the Willamette N.F. and BLM lands, and is almost absent on the Mt. Hood N.F. It generally occurs on moderately-steep and steep slopes. Slopes average 33% (range 0-85%). Plots are found on all slope positions. TSHE/MANE2-NWO Cascades communities frequently give way to TSHE/GASH-NWO Cascades communities on ridges or as topography becomes convex. Aspects vary, but south-facing slopes are most common. Most of the plots occur in the Old Cascades, generally below 3000 feet (average 2,040 ft., range 800-3,700 ft.). This association is often in an area of transition from western hemlock to the drier Douglas-fir series.

Soils sampled for the TSHE/GASH-NWO Cascades plant association are among the shallowest in the western hemlock zone.





## Vegetation Composition, Structure, and Diversity

The overstory in the TSHE/GASH-NWO Cascades association is dominated by Douglas-fir and western hemlock, often with a large component of western redcedar. Canopy closure of mature trees averages 70%. Cover of understory trees averages 10%.

This association has a moderately well developed shrub layer with tall shrubs averaging 25% cover and low shrubs averaging 46% cover. Salal dominates the shrub layer and there is usually a significant amount of vine maple. Other common shrubs include dwarf Oregon grape, red huckleberry and trailing blackberry.

Common name	Code	Constancy	Cover
<b>Overstory trees</b>			
Douglas-fir	PSME	100	45
Western hemlock	TSHE	88	24
Western redcedar	THPL	50	20
<b>Understory trees</b>			
Western hemlock	TSHE	90	7
Pacific dogwood	CONU4	33	4
Western redcedar	THPL	38	5
Golden chinquapin	CHCH7	38	3
<b>Shrubs</b>			
Salal	GASH	98	43
Dwarf Oregon grape	MANE2	98	5
Vine maple	ACCI	86	16
Red huckleberry	VAPA	86	3
Trailing blackberry	RUUR	79	1
Baldhip rose	ROGY	50	1
Rhododendron	RHMA3	40	10
<b>Herbaceous</b>			
Swordfern	POMU	86	5
Bracken fern	PTAQ	64	2
Pacific trillium	TROV2	60	1
Redwoods violet	VISE3	52	2
Twinflower	LIBO3	50	7
Star-flower	TRLA6	50	2
Three-leaved anemone	ANDE3	48	2

The herb layer is generally sparse, with an average herbaceous cover of 15%. Common species include swordfern, twinflower, bracken fern, Pacific trillium and redwoods violet. Moss cover averages 31%.

Stands in the TSHE/GASH-NWO Cascades association average 156 years (range 51-250 years). Stocking on these sites is relatively low, with live basal area averaging 240 ft<sup>2</sup>/acre.

Plots average 27 vascular plant species, about the mean for the western hemlock series in the Cascades.

### Management Implications

These sites are of average productivity for the series, with a mean site index of 137. Growing seasons are long and warm.

Regeneration should not be difficult as long as seedlings are established within three years of disturbance.

If sites are burned, snowbrush (*Ceanothus velutinus*) may germinate and compete with tree seedlings. Areas with shallow soils should be burned at low intensity to maintain site productivity.

	Site Index PSME	Site Index TSHE
Mean	137	127
SE	3	7
Range	60-196	120-134
Age	176	116
n	79	2

## Western hemlock/twinflower

*Tsuga heterophylla/Linnaea borealis*

TSHE/LIBO3

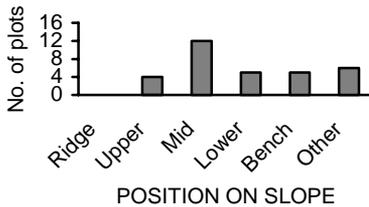
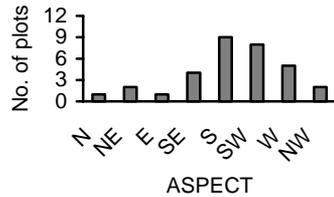
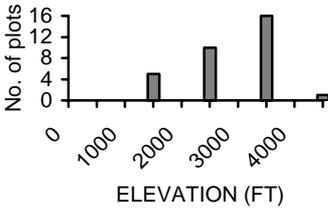
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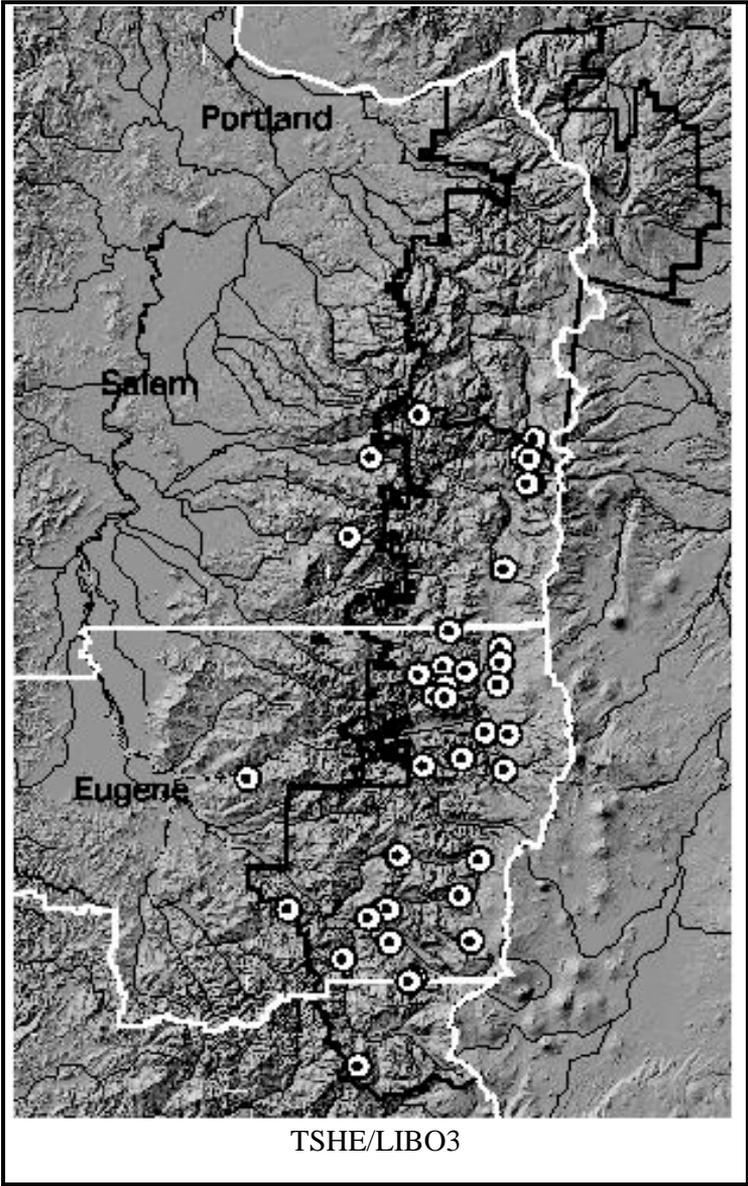
N=32 (WILL=29; EBLM=1; SBLM=2)

### Environment and Distribution

This plant association occurs in cool, moderate precipitation areas on the southern half of the study area. Plots are located on flat to moderate slopes averaging 22% (range 0-65%). This association is found primarily on mid-slope positions. Southerly to westerly aspects are most common. This association occurs at mid to higher elevations within the western hemlock zone, averaging 2,870 feet (range 1,220-4,500 ft.). This association is often transitional to the Pacific silver fir series.

Soils in the TSHE/LIBO3 association are frequently extremely shallow, but with deep organic accumulations.





## Vegetation Composition, Structure, and Diversity

The overstory in the TSHE/LIBO3 association is dominated by Douglas-fir and western hemlock, often with a large component of western redcedar. Canopy closure of mature trees averages 72%. Cover of understory trees averages 7%. This association has a sparse shrub layer with tall shrubs averaging 10% cover and low shrubs averaging 11% cover. The most common shrubs include dwarf Oregon grape, trailing blackberry, vine maple, prince's pine, and red huckleberry.

Common name	Code	Constancy	Cover
<b>Overstory trees</b>			
Douglas-fir	PSME	100	48
Western hemlock	TSHE	100	21
Western redcedar	THPL	59	17
<b>Understory trees</b>			
Western hemlock	TSHE	88	9
Western redcedar	THPL	56	4
Pacific yew	TABR2	50	4
<b>Shrubs</b>			
Dwarf Oregon grape	MANE2	72	3
Trailing blackberry	RUUR	69	2
Vine maple	ACCI	66	12
Prince's pine	CHUM	66	7
Red huckleberry	VAPA	63	3
<b>Herbaceous</b>			
Twinflower	LIBO3	97	22
Redwoods violet	WISE3	88	4
Rattlesnake plantain	GOOB2	69	1
Swordfern	POMU	66	7
Pacific trillium	TROV2	66	1
Three-leaved anemone	ANDE3	59	2
Vanilla leaf	ACTR	56	3
Bracken fern	PTAQ	53	1
Star-flower	TRLA6	50	3
Coolwort foamflower	TITR	47	2

Herbaceous cover averages 34%. Twinflower is the dominant herb. Other common forbs include redwoods violet, swordfern, rattlesnake plantain and Pacific trillium. Moss cover averages 47%.

Stands in the TSHE/LIBO3 association average 171 years (range 81-250 years). Stocking on these sites is relatively low, with live basal area averaging 244 ft<sup>2</sup>/acre.

Plots average 29 vascular plant species, slightly richer than average for the western hemlock series in the Cascades.

### Management Implications

These are moderately productive forest sites, with an average site index of 145. Tree regeneration may be complicated, especially on sites that have been burned, by competition with snowbrush (*Ceanothus velutinus*). Moderate intensity fires may damage shallow soils, which are common to this type.

	Site Index PSME
Mean	145
SE	2
Range	90-190
Age	181
n	66

## Western hemlock/skunk cabbage

*Tsuga heterophylla/Lystichitu americanum*

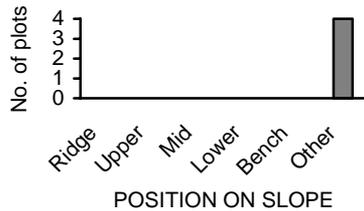
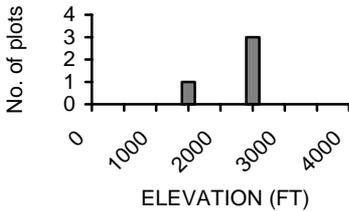
TSHE/LYAM3

CHM121

N=4 (MTH=4)

### Environment and Distribution

The TSHE/LYAM3 association occurs in the wettest parts of the western hemlock zone. It occurs throughout the study area, but was sampled only on the Mt. Hood. Plots are located in relatively flat slopes (average 3%, range 0-10%), generally riparian areas, such as alluvial bottoms or other wet, poorly drained sites. Often there is standing water, and soils tend to have a high organic matter content. These swampy sites may be regarded as wetland inclusions.



The locations of the TSHE/LYAM3 plots are not available in a map. If you would like to know more about their locations, please contact the ecology program.

## Vegetation Composition, Structure, and Diversity

The overstory canopy is generally a mix of red alder, Douglas-fir, western redcedar, and western hemlock. Canopy closure of mature trees averages 69%. Cover of understory trees averages 4%. This association has a moderate tall shrub layer, averaging 35% cover, and a very sparse low shrub layer, averaging 1% cover.

Common name	Code	Constancy	Cover
<b>Overstory trees</b>			
Red alder	ALRU2	75	42
Western redcedar	THPL	75	35
Douglas-fir	PSME	75	22
Western hemlock	TSHE	50	30
<b>Understory trees</b>			
Western hemlock	TSHE	100	4
Western redcedar	THPL	75	1
<b>Shrubs</b>			
Vine maple	ACCI	100	32
Trailing blackberry	RUUR	100	2
Thimbleberry	RUPA	50	3
Red elderberry	SARA2	50	2
Red huckleberry	VAPA	50	1
<b>Herbaceous</b>			
Skunk cabbage	LYAM3	100	34
Ladyfern	ATFI	100	18
Wild ginger	ASCA2	75	2
Oregon oxalis	OXOR	75	3
Swordfern	POMU	75	9
Great betony	STME	75	2
Coolwort foamflower	TITR	75	16
Piggyback plant	TOME	75	14
Miner's lettuce	CL SIS	50	4
<b>Grasses/Grass likes</b>			
Sedge	CAREX	100	2
Field woodrush	LUCA2	50	2
Bearded fescue	FESU	50	1

The major shrub is vine maple. Herbaceous cover averages 79%. This is a much higher herbaceous cover than the 36% average value for the western hemlock zone. Moss cover averages 46%.

This association is found in very wet sites and is rich in moisture-loving herbaceous species. The characteristic forbs are skunk cabbage, ladyfern, great betony, wild ginger, piggyback plant, and a variety of sedges and rushes.

Species composition in all layers (overstory, shrubs and forbs) varies considerably from site to site, as this is currently an umbrella type for swampy western hemlock zone forested wetland sites. A notable feature of this association is the open, broken canopy, caused by a combination of disease-related top damage, wind throw and treeless patches of standing water.

Often the TSHE/LYAM3 association is either transitional to non-forest wetland, or represents small “pockets” of swampy conditions within a larger, more mesic area. The TSHE/LYAM3 association is easily distinguished from other riparian types by the absence of devil’s club. It is not likely to be confused with any other associations.

### Management Implications

The TSHE/LYAM3 association represents moderate to low productivity. These sites may fit wetland definitions, and sometimes may be considered riparian inclusions. Because these sites are excessively moist, decreased productivity due to soil erosion and/or compaction can result from ground disturbance. In addition, poorly aerated soils with high organic material content may be difficult to reforest following logging. Such soils are not only physically hard to work in, but may have chemical conditions unfavorable to the growth of Douglas-fir. In addition, shallow rooting may contribute to a greater potential for wind-throw in certain sites. Use of western redcedar, red alder or black

cottonwood may be considered for reforestation where “swampy” conditions prevail.

Sample size is small (N=4) for the TSHE/LYAM3 association, so stand stocking and basal area statistics are not presented. Two site trees were measured for a site index value of 112, suggesting that it is one of the least productive associations in the western hemlock zone.

## Western hemlock/devil's club/Oregon oxalis

*Tsuga heterophylla*/*Oplopanax horridum*/*Oxalis oregana*

TSHE/OPHO/OXOR

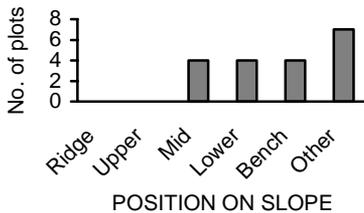
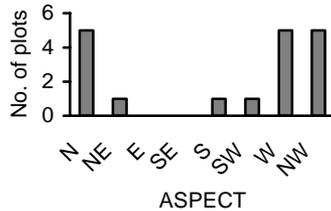
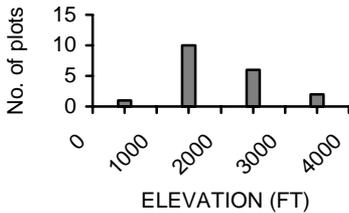
CHS522

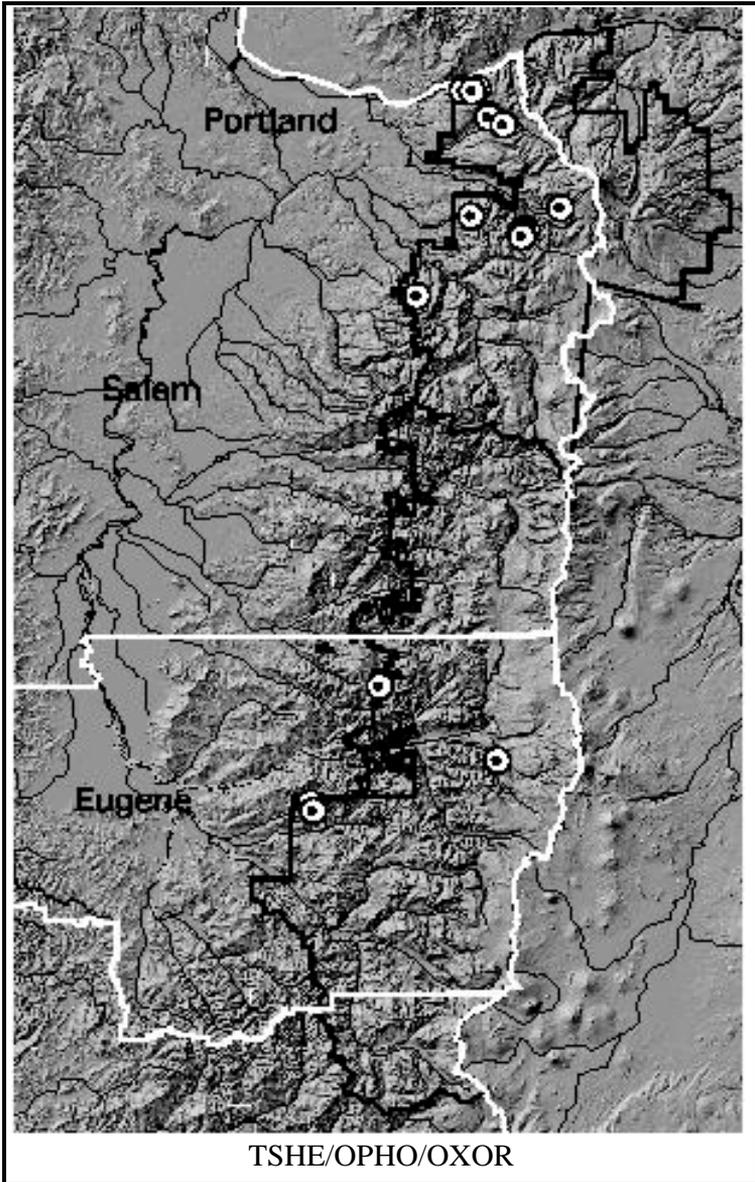
N=19 (MTH=13; WILL=6)

### Environment and Distribution

The TSHE/OPHO/OXOR association occupies warm, wet sites. This association is found mainly in riparian areas and colluvial toe slopes where water seeps accumulate. Benches and lower- to mid-slope positions are common; this association is not found on upper slopes or ridges. Plots occur primarily on cool north, northwest and westerly aspects. Plots are on gentle to moderate slopes, averaging 24% (range 0-65%). This association occurs at low to mid elevations, with elevation of plots averaging 2,048 feet (range 880-3,240 ft.).

The TSHE/OPHO/OXOR association indicates a year-round moist-to-wet well-aerated soil condition.





## Vegetation Composition, Structure, and Diversity

The overstory in the TSHE/OPHO/OXOR association is dominated by western hemlock and Douglas-fir, often with a large component of western redcedar. Canopy closure of mature trees averages 65%. Cover of understory trees averages 7%. As in the TSHE/LYAM3 association, the canopy is often quite open, and may contain a relatively large number of broken-topped trees. This association has a relatively well-developed shrub layer, with tall shrubs averaging 36% cover and low shrubs averaging 7% cover. Devil's club is the dominant shrub species, with an average cover of 20%, and is always present in TSHE/OPHO/OXOR. Other common shrub species include vine maple and red huckleberry.

Common name	Code	Constancy	Cover
<b>Overstory trees</b>			
Western hemlock	TSHE	100	36
Douglas-fir	PSME	100	31
Western redcedar	THPL	63	17
<b>Understory trees</b>			
Western hemlock	TSHE	100	8
<b>Shrubs</b>			
Devil's club	OPHO	100	20
Red huckleberry	VAPA	89	5
Vine maple	ACCI	68	16
<b>Herbaceous</b>			
Oregon oxalis	OXOR	95	59
Swordfern	POMU	95	10
Ladyfern	ATFI	84	5
Coolwort foamflower	TITR	84	3
Starry false Solomon's seal	MAST4	74	5
Hooker fairybells	DIHO3	63	1
Pacific trillium	TROV2	63	1
Deerfern	BLSP	58	3
Inside-out-flower	VAHE	58	3
Woodfern	DRAU8	53	2
False lily of the valley	MADI	47	5

Herbaceous cover averages 74%, twice the mean herb cover for the western hemlock series. In addition to the prevalent Oregon oxalis, other moist-site herbs such as starry false Solomon’s seal, lady fern, coolwort foamflower, and Hooker fairybells are common. Moss cover averages 28%.

Sampled stands in the TSHE/OPHO/OXOR association average 198 years (range 96-291 years).

Plots average 32 vascular plant species, making this one of the more diverse associations within the western hemlock zone.

Management Implications

These are some of the most productive sites in the western hemlock series. Stocking on these sites is relatively low, with live basal area averaging 227 ft<sup>2</sup>/acre. Even though stocking is somewhat low, per acre volume productivity remains high due to the very large size of trees. This reflects the abundant moisture, deep, fine-textured soil and high level of soil organic matter characteristic of sites where the association is found.

	Site Index PSME	Site Index TSHE
<b>Mean</b>	162	129
<b>SE</b>	5	11
<b>Range</b>	96-206	93-163
<b>Age</b>	290	249
<b>n</b>	27	6

These are highly productive sites, with an average site index of 162. Because these sites may be excessively moist, decreased productivity due to soil erosion and/or compaction may result from ground disturbance. In

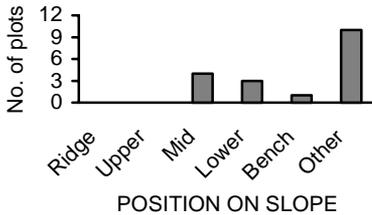
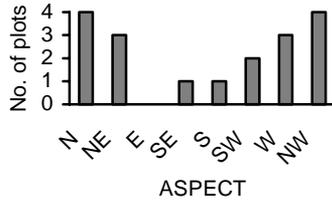
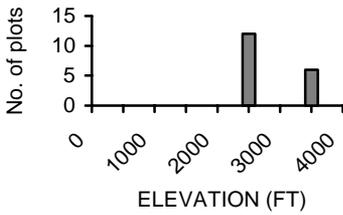
addition, poorly aerated soils with high organic material content may be difficult to reforest following logging. Such soils are not only physically difficult to work in, but may also have chemical conditions unfavorable to the growth of Douglas-fir. Use of western redcedar, red alder or black cottonwood may be considered where “swampy” conditions are found.

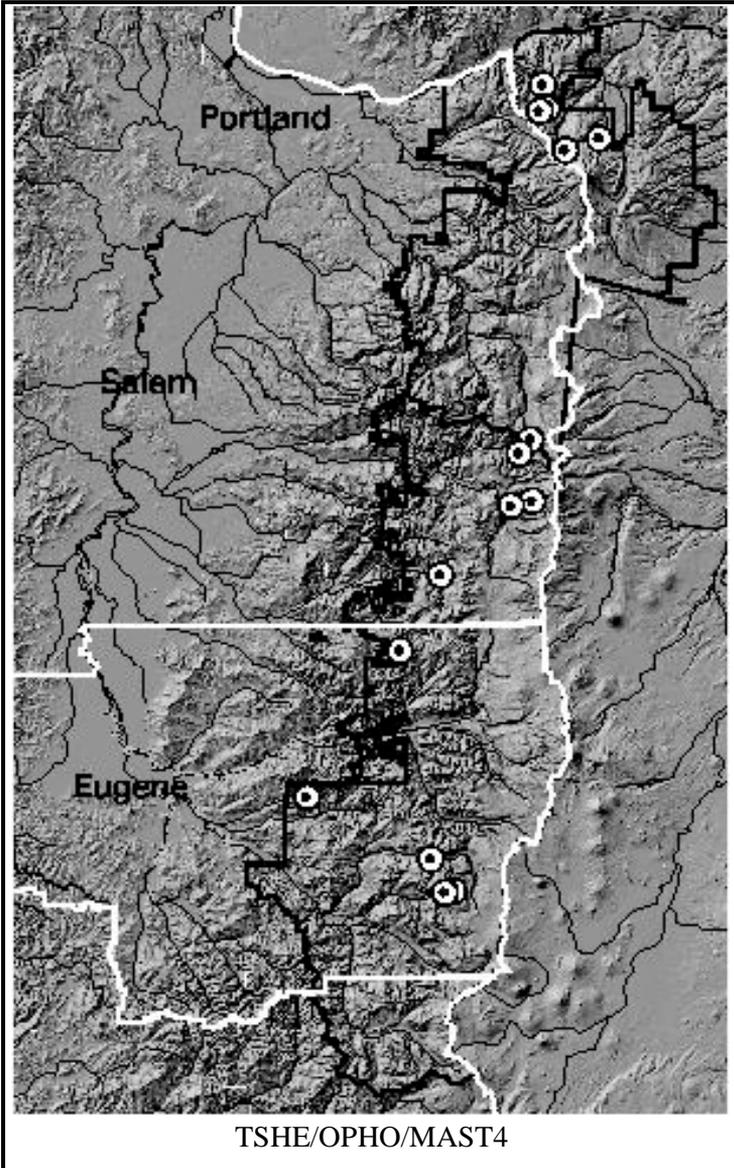
**Western hemlock/devil's club/starry false Solomon's seal**  
*Tsuga heterophylla*/*Oplopanax horridum*/*Maiathemum stellata*  
 TSHE/OPHO/MAST4  
 (old code: TSHE/OPHO/SMST)  
 CHS525  
 N=18 (MTH=6; WILL=12)

Environment and Distribution

This plant association is found primarily along major creeks at mid to higher elevations within the western hemlock zone (average elevation is 2,723 feet, range 2,000-3,700 ft.). The TSHE/OPHO/MAST4 association also occurs in isolated wet areas, representing a combination of abundant water and impeded drainage. The sites are primarily flatter areas along drainages or seeps, but may also be found on lower to mid slopes. Average slope is 17% (range 0-60%).

Soils on these sites are well aerated but saturated virtually year-round. Plots occur primarily on north to westerly aspects.





## Vegetation Composition, Structure, and Diversity

The overstory in the TSHE/OPHO/MAST4 association is dominated by western hemlock and Douglas-fir, often with a large component of western redcedar. Canopy closure of mature trees averages 68%. Cover of understory trees averages 4%. As with other wet-site associations, there is a relatively large amount of tree breakage and mortality due to disease and wind throw.

Common name	Code	Constancy	Cover
<b>Overstory trees</b>			
Western hemlock	TSHE	100	31
Douglas-fir	PSME	94	37
Western redcedar	THPL	67	20
<b>Understory trees</b>			
Western hemlock	TSHE	94	4
<b>Shrubs</b>			
Devil's club	OPHO	100	30
Vine maple	ACCI	83	27
Red huckleberry	VAPA	78	2
Dwarf Oregon grape	MANE2	44	8
Baldhip rose	ROGY	44	2
<b>Herbaceous</b>			
Coolwort foamflower	TITR	94	14
Swordfern	POMU	94	5
Starry false Solomon's seal	MAST4	89	13
Ladyfern	ATFI	83	10
Wild ginger	ASCA2	78	3
Vanilla leaf	ACTR	72	7
Queencup beadlily	CLUN2	72	3
Bunchberry dogwood	COCA13	72	10
Inside-out flower	VAHE	72	10
Three-leaved anemone	ANDE3	61	1
Sweetscented bedstraw	GATR3	61	2
Pacific trillium	TROV2	61	1
Twinflower	LIBO3	56	4
Hooker fairybells	DIHO3	50	2
Redwoods violet	WISE3	50	3
Pathfinder	ADBI	44	3
Rattlesnake plantain	GOOB2	44	1
Red baneberry	ACRU2	44	1

This association has a well-developed shrub layer, with tall shrubs averaging 45% cover and low shrubs 11% cover. Devil’s club is the predominant shrub species, with an average cover of 30%. Devil’s club is always present in the TSHE/OPHO/MAST4 association. Other common shrub species include vine maple, dwarf Oregon grape, red huckleberry and baldhip rose.

This association is floristically similar to TSHE/OPHO/OXOR, but the lush understory consists of a number of moist-site herbs (starry false Solomon’s seal, coolwort foamflower, dogwood bunchberry, vanillaleaf, inside-out flower, and queencup beadlily). Oregon oxalis is absent. Herbaceous cover averages 64%, which is much higher than the 36% average value for the western hemlock zone in the Cascades. Moss cover averages 31%.

Stands in the TSHE/OPHO/MAST4 association average 211 years (range 70-250 years). Basal area for this association is high, 400 ft<sup>2</sup>/acre (from a single sample).

Plots average 33 vascular plant species, making this one of the most diverse associations within the western hemlock series.

Management Implications

These are productive sites, with an average site index of 146. This may be due to deeper soil on toe slope positions, with accumulation of water and nutrients.

	Site Index ABGR *	Site Index ABPR	Site Index PSME	Site Index TSHE
<b>Mean</b>	105	153	146	124
<b>SE</b>	1	9	4	8
<b>Range</b>	140-105	136-163	124-191	112-148
<b>Age</b>	144	75	214	134
<b>n</b>	4	3	22	4

\* SI for ABGR was calculated using a base-age of 50. ABPR, PSME and TSHE were calculated using base 100.

Because these sites may be wet, decreased productivity due to soil erosion and/or compaction may result from ground disturbance. Poorly aerated soils with high organic material content may be difficult to reforest following logging. Such soils are not only physically difficult to work in, but may also have chemical conditions unfavorable to the growth of Douglas-fir. Use of western redcedar, red alder or black cottonwood may be considered where “swampy” conditions are found.

**[Click here to continue to the second half of the western hemlock series \(in separate file\)](#)**